Atlas Monitor

Service Manual

Atlas Patient Monitor

Welch Allyn
8500 SW Creekside Pl
Beaverton, Oregon 97008
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6200-43E Revision D

Part No.	Rev.	Description	ECN#	Date	Approved
6200-43E	A	New release of Atlas Service Manual	5-40429	10/99	RS/LP
6200-43E	B	Updated calibration procedures Updated performance verification procedures Updated drawing 620150 Rev B to Rev C Updated drawing 620201 Rev A to Rev B Updated drawing 620524 Rev A to Rev B Added complete repair parts lists. Added calibration date table	5-44782	07/02	DK
6200-43E	C	Updated to reflect changes in hardware and software	5-45730	03/03	DK

Drawings and/or illustrations and/or part numbers contained in this document are for reference purposes only. For current revisions call the Welch Allyn Customer Service phone number listed in Section 1 page 2.

CONTENTS

List of Figures vi
List of Tables ix

Section 1: General Information

About the Atlas Monitor 1
Help Information 2
Agency Approvals 3
Warning, Cautions and Notes 3
Product Model Number Structure 5
623xP Main Menu Architecture 6
622xP Main Menu Architecture 7
621xP Main Menu Architecture 8
Atlas System Block Diagram 9

Section 2: Service

Incoming Inspection 11
Calibration and Maintenance Schedule 12
Setting Date and Time 14
Pangea Communication Protocol 14
BP Calibration 14
50mmHg Calibration 17
250mmHg Calibration 17
CO_2 Reset (623xx Models Only) 18
ET CO_2 Calibration 19
No-Load Battery Voltage Calibration 20
Battery Voltage Calibration 21
Printer Print Adjustment 22
Temperature Calibration 23
Calibration Date Set 24
Explanation of an Atlas Service Screen 25
Software Upgrade Procedure 27
Down Loading NVRAM Files 28

Section 3: Functional tests and Trouble Shooting

Power on Self Test 37
Menu Functional Test 38
BP Test 40
Static Manometer Accuracy Test 41
BP Leak Test 42
Over 15 mmHg Test 42
BP Dump Verification Test 43
Hardware Fail Safe Tests 43
ECG/Respiration Test 44
SpO_2 Test 45
Temperature Test 45
CO_2 Functional Test 45
Battery Functional Test 46
Printer Functional Test 47
Print on Alarm Test 47
Software/Firmware 47
ECG Alarms Test 48
Respiration Alarms Test 50
SpO_2 Alarm Test 51
Silence Alarm Test 52
CO_2/RESP Test 52
Blood Pressure Alarm Test 53
Trouble Shooting 56

Section 4: Disassembly and Repair

About Section 4 63
Battery Door Removal 64
Battery Removal 64
Rear Housing Removal 65
Printer Cable and Display Cable Removal 66
Power Supply Ground Wire Removal 66
Tie Wrap Removal 67
CPU Removal 67

Main PCB Removal 67
Main PCB Side Connector Removal 68
Main PCB Hose and Wire Removal. 68
Pump Removal. 68
CO_2 Exhaust Removal 69
Pryon PCB Removal. 69
E-Pac Foam Removal (Top). 69
Power Supply Removal. 70
Power Supply Fuse Location 70
Fan Removal 70
E-Pac Removal (Lower) 71
Deflection PCB Removal 71
CRT Removal 71
Display PCB Removal 72
Printer Door Button Removal 73
Printer Assembly Locking Tab Release. 73
Printer Positioning Slot Removal 74
Printer Assembly Removal. 74
Printer Lip Assembly. 74
Printer Cable Routing. 75

Appendix A: Theory of Operation

Power Supply Circuits 77
Model 622 and Model 623 80
On/Off Circuits 81
Battery Charger 84
NIBP Circuits 87
CRT Deflection Board 92
Vertical Amplifier: 92
Recorder Electronics 96
Power Supply – 24 Switcher 96
Motor Driver: 97
Patient Isolated Circuits 98
Linear Regulators and Filtering – Model 621 99

Linear Regulators and Filtering – Model 622 and 623 100
A/D Circuits 101
A/D Multiplexer 102
Serial Communication 103
Signal Isolation 104
ECG Circuits 104
Impedance Respiration (Model 622/623 only) 109
SpO_2 Circuits 110

Appendix B: Repair Parts Lists

621N0 113
621NP 116
621S0 119
621SP 121
622N0 124
622NP 127
622S0 130
622SP 133
623NP 136
623SP 142

Appendix C: Interconnect Diagram

Interconnect diagram 620396 Rev A 145

Appendix D: Atlas Drawings and Electrical Schematics

See List of Figures on page v for individual drawings 146

Appendix E: Calibration Date Table

Calibration Date Index Table. 187

Appendix F: Serial Number Cut in History. 211

Appendix G: Atlas Calibration and Functional Test Form 213

List of Figures

Figure 1-1. 623xP Main Menu Architecture. 6
Figure 1-2. 622xP Main Menu Architecture. 7
Figure 1-3. 621xP Main Menu Architecture. 8
Figure 1-4. Atlas System Block Diagram 9
Figure 2-1. Example of a new HyperTerminal connection. 15
Figure 2-2. Choosing COM1 in HyperTerminal. 15
Figure 2-3. HyperTerminal Port Settings. 16
Figure 2-4. Photo of Atlas BP calibration setup. 17
Figure 2-5. Example of CO_2 calibration setup. 21
Figure 2-6. Example and Explanation of an Atlas Service Screen 25
Figure 2-7. Pangea prompt in HyperTerminal 29
Figure 2-8. Choosing “Send Text File” in HyperTerminal 29
Figure 2-9. Choosing directory where NVRAM files are stored. 30
Figure 2-10. Choosing the nvram_cal_init.txt file. 30
Figure 2-11. Pangea screen after opening the nvram_cal_init.txt file. 31
Figure 2-12. Pangea screen after opening the nvram_common.txt file. 31
Figure 2-13. Pangea prompt after opening the model# file. 32
Figure 2-14. Pangea screen after loading a language file. 33
Figure 2-15. Pangea screen after downloading the nvram_printer.txt file. 34
Figure 2-16. Pangea screen nvram set serial command. 35
Figure A-1. Model 621 DC/DC circuit block diagram. 77
Figure A-2. On/Off Control Circuits. 78
Figure A-3. Model 621 Buck converter. 79
Figure A-4. Model 621 linear regulation. 80
Figure A-5. DC/DC circuit diagram. 81
Figure A-6. Boost converter and off/on switch. 82
Figure A-7. Boost converter. 83
Figure A-8. Battery charging. 85
Figure A-9. Linear regulator. 86
Figure A-10. NIBP PWM A/D converter. 86
Figure A-11. PWM timing. 87
Figure A-12. Primary transducer amplifier. 89
Figure A-13. Safety transducer amplifier. 90

Figure A-14. Over pressure fault circuit. 91
Figure A-15. Pump relay circuit. 91
Figure A-16. Ramp generator circuit. 92
Figure A-17. Vertical amplifier circuit 93
Figure A-18. Horizontal amplifier grid voltage circuit. 95
Figure A-19. Video amplifier circuit. 96
Figure A-20. Recorder power supply circuit. 97
Figure A-22. Print head temperature circuit. 98
Figure A-23. Patient isolation circuit. 99
Figure A-24. Model 621 line regulation and filtering. 99
Figure A-25. Model 622/623 line regulation and filtering. 100
Figure A-26. A/D converter circuit. 101
Figure A-27. A/D multiplexer circuit. 102
Figure A-28. Serial communication circuit. 104
Figure A-29. Defib protect and RFI filtering circuit. 105
Figure A-30. Input buffer circuit. 105
Figure A-31. Lead select circuit. 106
Figure A-32. Differential amp/slew rate amp circuit. 107
Figure A-33. Right leg drive circuit. 107
Figure A-34. High pass and gain stage circuit. 108
Figure A-35. Temperature amplifier circuit. 108
Figure A-36. Respiration drive circuit. 109
Figure A-37. Respiration diff amp circuit. 110
Figure A-38. Gain and filter circuit. 110
Figure C-1. Atlas Interconnect Diagram 145
Figure D-1. Atlas model 200 main board. 147
Figure D-2. Atlas model 200 NIBP electronics. 148
Figure D-3. Atlas model 200 power supply 149
Figure D-4. Atlas Power isolation /SpO_2 interface. 150
Figure D-5. Atlas model 200 ECG amp. 151
Figure D-6. Atlas ECG A/D interface 152
Figure D-7. Atlas CPU subsystem. 153
Figure D-8. Atlas FPGA. 154
Figure D-9. Atlas 200/210/220 I/O filters. 155

Figure D-10. Flash, SDRAM HRESET config word. 156
Figure D-11. Power PC MP C823 CPU. 157
Figure D-12. Power distribution. 158
Figure D-13. Front panel display. 159
Figure D-14. Key board scanner. 160
Figure D-15. Temp/pulse LED drivers. 161
Figure D-16. NIBP LED drivers. 162
Figure D-17. SpO_2 LED drivers. 163
Figure D-18. CRT deflection board. 164
Figure D-19. Printer electronics. 165
Figure D-20. Model 220 main board. 166
Figure D-21. 210/220 NIBP electronics. 167
Figure D-22. DC/DC power supply. 168
Figure D-23. Power isolation/SpO_2 interface. 169
Figure D-24. 210/220 ECG amp. 170
Figure D-25. 210/220 ECG A/D interface. 171
Figure D-26. 210/220 Respiration circuit. 172
Figure D-27. 210/220 serial communication. 173
Figure D-28. 200/210/220 transformer isolation. 174
Figure D-29. 200/210/220 ECG patient cable. 175
Figure D-30. 200/210/220 power supply sub assy. 176
Figure D-31. 220 $ETCO_2$ PCB assembly. 177
Figure D-32. 200/210/220 Power supply. 178
Figure D-33. Nonin SpO_2 Board. 179
Figure D-34. Motor Stepper. 180
Figure D-35. Pump Pneumatic. 181
Figure D-36. 200/210/220 ECG cable assembly. 182
Figure D-37. CO_2 cable assembly. 183
Figure D-38. Nellcor sensor cable assy. 184
Figure D-39. 200/210/220 Pneumatic sub assy. 185
Figure D-40. 220 CO_2 cable assy. 186

List of Tables

Table 1-1. Operator manual part numbers. 1
Table 2-1. Atlas Packing List. 11
Table 2-2. Tools Required for Service. 13
Table 2-3. Software Revision Table 26
Table 2-4. Files needed to download language(s). 33
Table 3-1. Transducer pressure table. 41
Table 3-2 Resistor and temperature reference. 45
Table 3-3. Atlas failure trouble shooting. 56
Table 3-4. Atlas failure trouble shooting. 57
Table 3-5. Atlas failure trouble shooting. 58
Table 3-6. Atlas failure trouble shooting. 59
Table 3-7. Atlas failure trouble shooting. 60
Table 3-8. Atlas failure trouble shooting. 61
Table A-1. Temperature coefficient. 84
Table B-1. Atlas 621N0 repair parts 113
Table B-2. Atlas 621NP repair parts. 116
Table B-3. Atlas 621S0 repair parts. 119
Table B-4. Atlas 621SP repair parts. 121
Table B-5. Atlas 622N0 repair parts. 124
Table B-6. Atlas 622NP repair parts. 127
Table B-7. Atlas 622S0 repair parts. 130
Table B-8. Atlas 622SP repair parts. 133
Table B-9. Atlas 622NP repair parts. 136
Table B-10. Atlas 623SP repair parts. 139
Table B-11. Atlas 623NP repair parts. 142
Table D-1. Atlas drawings revision page. 146
Table F-1. Changed to a new BP Valve. 211
Table F-2. Changed E-Pac and Changed to class B power supply. 211
Table F-3. Upgraded printer cable to a cable with foam tape. 211
Table F-4. Upgraded Revision level of CPU from 501 to 502. 211
Table F-5. Upgraded Revision level of Nellcor SpO_2 to 506 212

About the Atlas Monitor

The Atlas Monitor combines in one unit all the necessary measurements for patients under anesthesia, for surgical recovery, or bed side monitoring. See Section 1, page 5 for a complete listing of product models and options.

According to the standards of care for Nurse Anesthetists and Anesthesiologists, all patients receiving conscious sedation are to be continuously monitored throughout the procedure and recovery phase by ECG, SpO_2, and NIBP. CO_2 monitoring is a requirement during gas anesthesia (when patient is ventilated).

The Atlas combines a CRT to display ECG, CO_2, SpO_2, and respiration waveforms. It utilizes LEDs for the other numeric values to maximize visibility and viewing angle. Although not designed to be a transport product, the monitor has an integral handle and it is small and light enough at 13 lbs. to be easily moved.

A battery was added to enable the monitor to be used if there is a power outage or to be unplugged momentarily when moved with the patient from the surgery room to the recovery room. The battery was not designed to make the Atlas into a transport monitor. The Atlas monitor should be plugged into AC as much as possible to give you the maximum battery backup time when there is a power outage. It will maintain unit operation for up to an hour when power is interrupted if the battery is fully charged.

WARNING: Discharging the battery frequently will shorten the battery life and will shorten the battery backup time.

IMPORTANT: For a complete description on the function and use of the Atlas, as well as user safety warnings, cautions, and warranty information, read and understand the Atlas Operator's Manual. See the Table 1-1 below for correct Operator's Manual part #.

Table 1-1. Operator manual part numbers.

Language	Part#
English	6200-42E
French	6200-42F
German	6200-42G
Italian	6200-42I
Spanish	6200-42S
Portuguese	6200-42P
Japanese	6200-42J
Chinese	6200-42C

Help Information

To assure correct operation and performance all service and repairs must be performed by fully trained and properly equipped personnel, using genuine replacement parts and correct procedures. Failure to do so will also invalidate the product warranty.

Welch Allyn Inc.
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Skaneateles Falls, NY 13153-0220, USA

tel: 1-800-535-6663
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Tokyo 101-0051
Japan

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fax: (011) 813-3261-7372

Agency Approvals

ETL Listed
UL2601-1,
CSA C22.2 No. 601.1
IEC 60601-1, AS 3200.1
IEC 60601-1-2

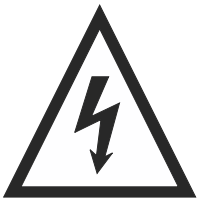
The CE mark on this product indicates that it has been tested to and conforms with the provisions noted within the 89/336/ECC Electromagnetic Compatibility Directive.

Australia EMC Framework Compliance

Warning, Cautions and Notes

All operating and service personnel should be familiar with the general safety information in this summary. Specific warnings and cautions will also be found throughout the operators manual. Such specific warnings and cautions may not appear here in the summary.

Defbrillator-Proof, Type CF Alllied Part

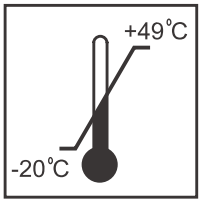


Electrical Shock Hazard

ATTENTION. Consult accompanying document

Handle With Care

Storage Humidity. Refer to technical specifications in operator's for more details.



Storage temperature. Refer to technical specifications in operator's manual for more details.

Lead Acid Battery. For disposal see maintenance section in opertor's manual

Product Model Number Structure

621S0-E1 ECG, Nonin SpO_2, NIBP

621SP-E1 ECG, Nonin SpO2, NIBP, Printer

621N0-E1 ECG,Nellcor SpO2,NIBP

621NP-E1 ECG,Nellcor SpO_2,NIBP, Printer

622S0-E1 ECG, Nonin SpO_2, NIBP, Temp, Respiration, Battery, RS232

622SP-E1 ECG, Nonin SpO_2, NIBP, Temp, Respiration, Battery, RS232, Printer

622N0-E1 ECG, Nellcor SpO_2, NIBP, Temp, Respiration, Battery, RS232

622NP-E1 ECG, Nellcor SpO_2, NIBP, Temp, Respiration, Battery, RS232, Printer

623SP-E1 ECG, Nonin SpO_2, NIBP, $ETCO_2$, Temp, Respiration, Battery, RS232, Printer

623NP-E1 ECG, Nellcor SpO_2, NIBP, $ETCO_2$, Temp, Respiration, Battery, RS232, Printer

Product Structure Meaning:

The first three digits in the product structure sequence designates the model number. The fourth character in the sequence designates the SpO_2. The fifth character in the sequence designates if it has a printer or not. The first suffix designates the country language when shipped. The second suffix designates the power cord shipped with the Atlas.

First Three Characters: Model number, 621, 622, 623

Fourth Character: N=Nellcor SpO_2, S=Nonin SpO_2

Fifth Character: P=Printer, 0=No Printer

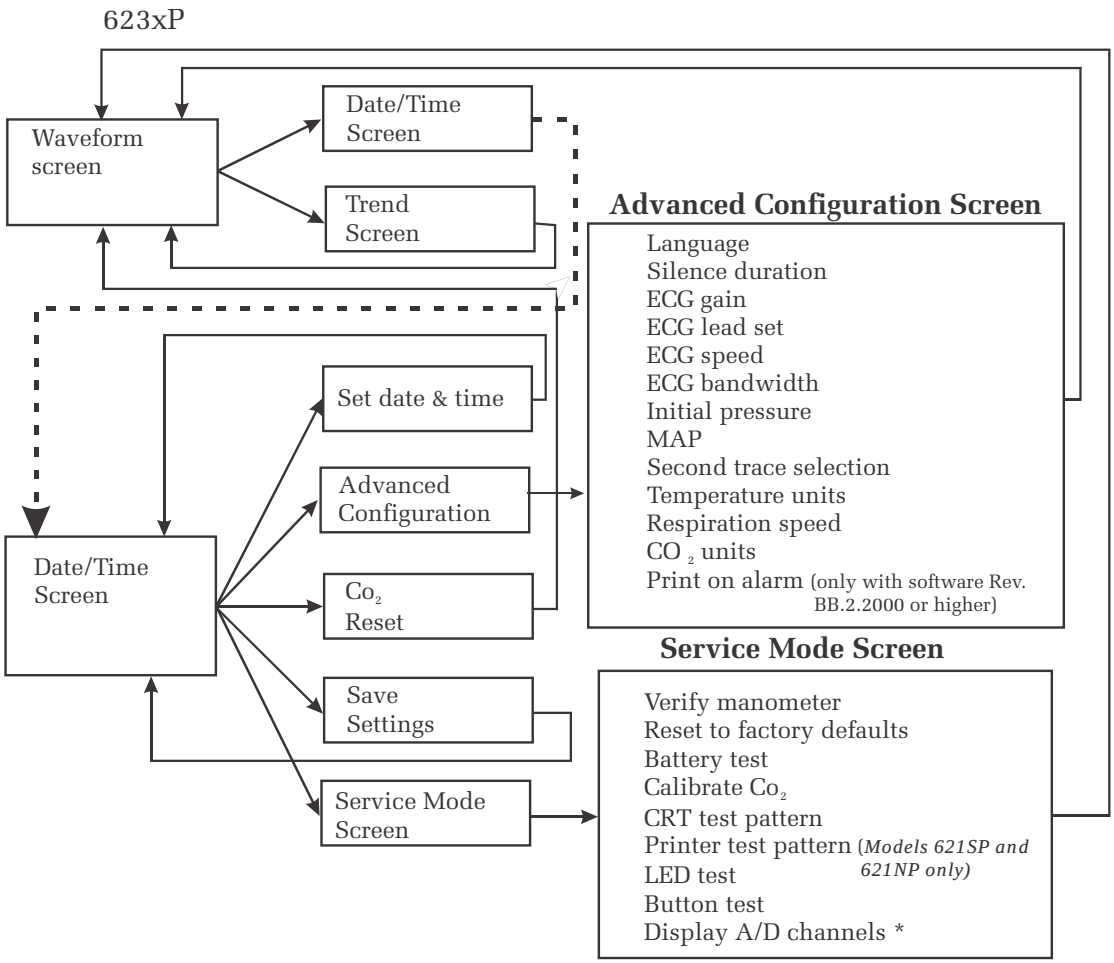
First Suffix: E = English, F= French, G= German, I= Italian, S= Spanish, P= Portuguese C = Chinese,
J= Japanese

Second Suffix:

1 = US, Canada, Japan
2 = European
4 = United Kingdom
6 = Australian

623xP Main Menu Architecture

Figure 1-1. 623xP Main Menu Architecture.

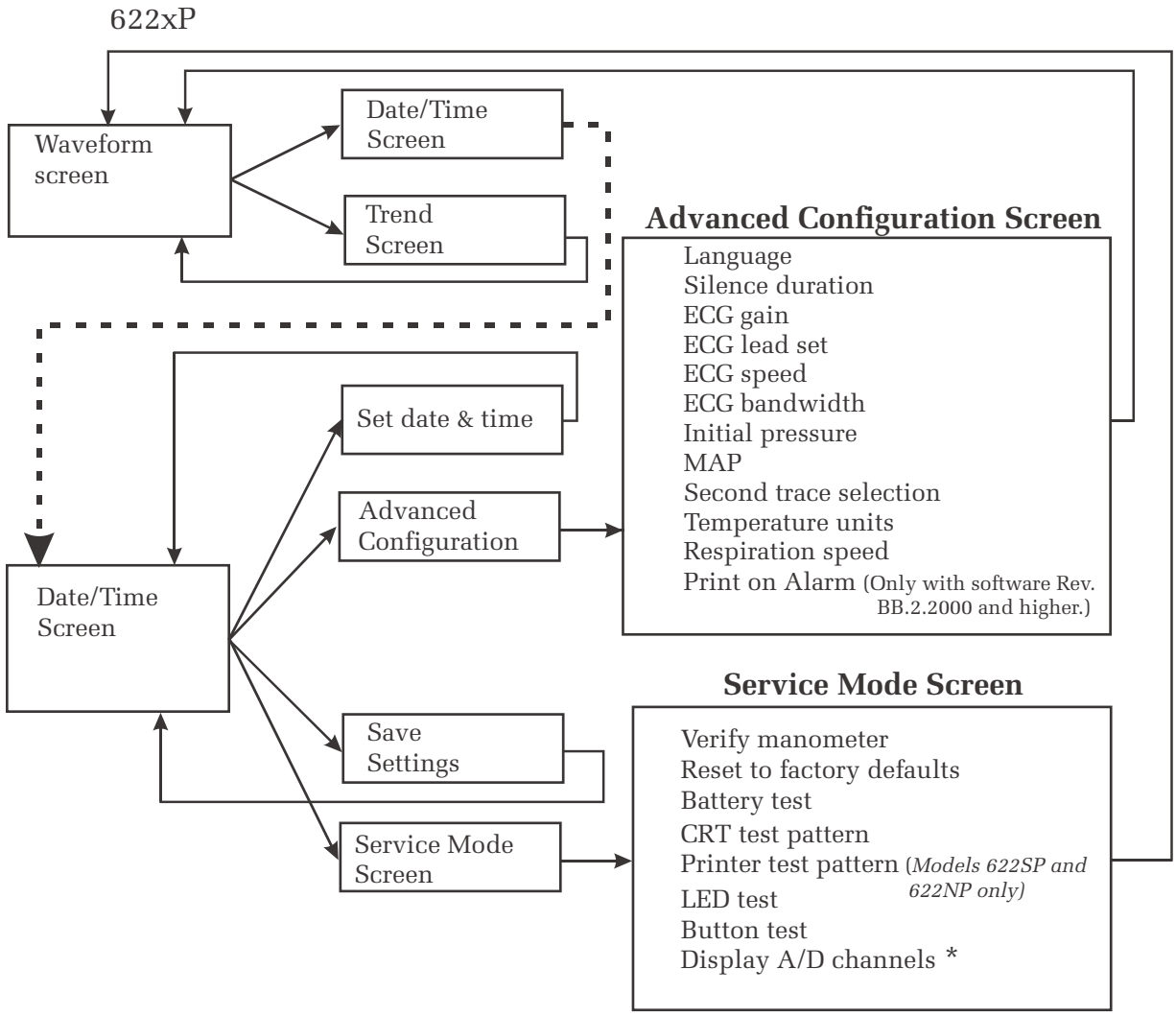


NOTE: *The **Print on alarm** function in **Advanced configuration** mode screen is only available with software version **BB.2.20**00 and higher.*

* ***NOTE:*** *The **Display A/D channels** function in the **Service Mode Screen** only allows you to view system information by pressing the **SET** button. It does not allow you to change system settings.*

622xP Main Menu Architecture

Figure 1-2. 622xP Main Menu Architecture.



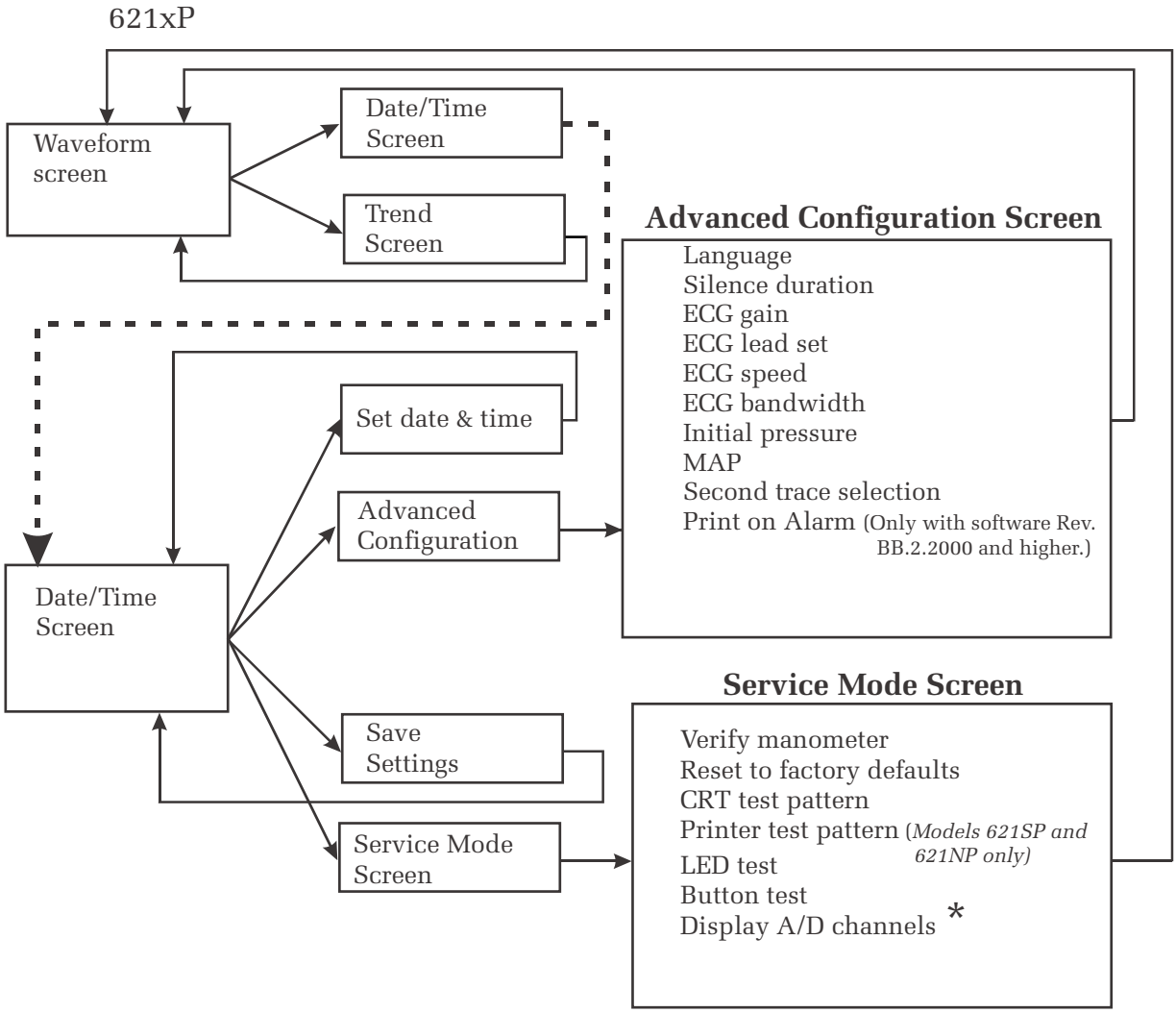
NOTE: ***The Print on alarm*** *function in* ***Advanced Configuration Screen*** *is only available with software version* ***BB.2.2000*** *and higher.*

NOTE: *On models 622S0 and 622N0 delete the* ***Print test pattern*** *function in the* ***Service Mode Screen****. Model 622S0 and 622N0 do not come with printers.*

* ***NOTE:*** *The* ***Display A/D channels*** *function in the* ***Service Mode Screen*** *only allows you to view system information by pressing the* ***SET*** *button. It does not allow you to change system settings.*

621xP Main Menu Architecture

Figure 1-3. 621xP Main Menu Architecture.



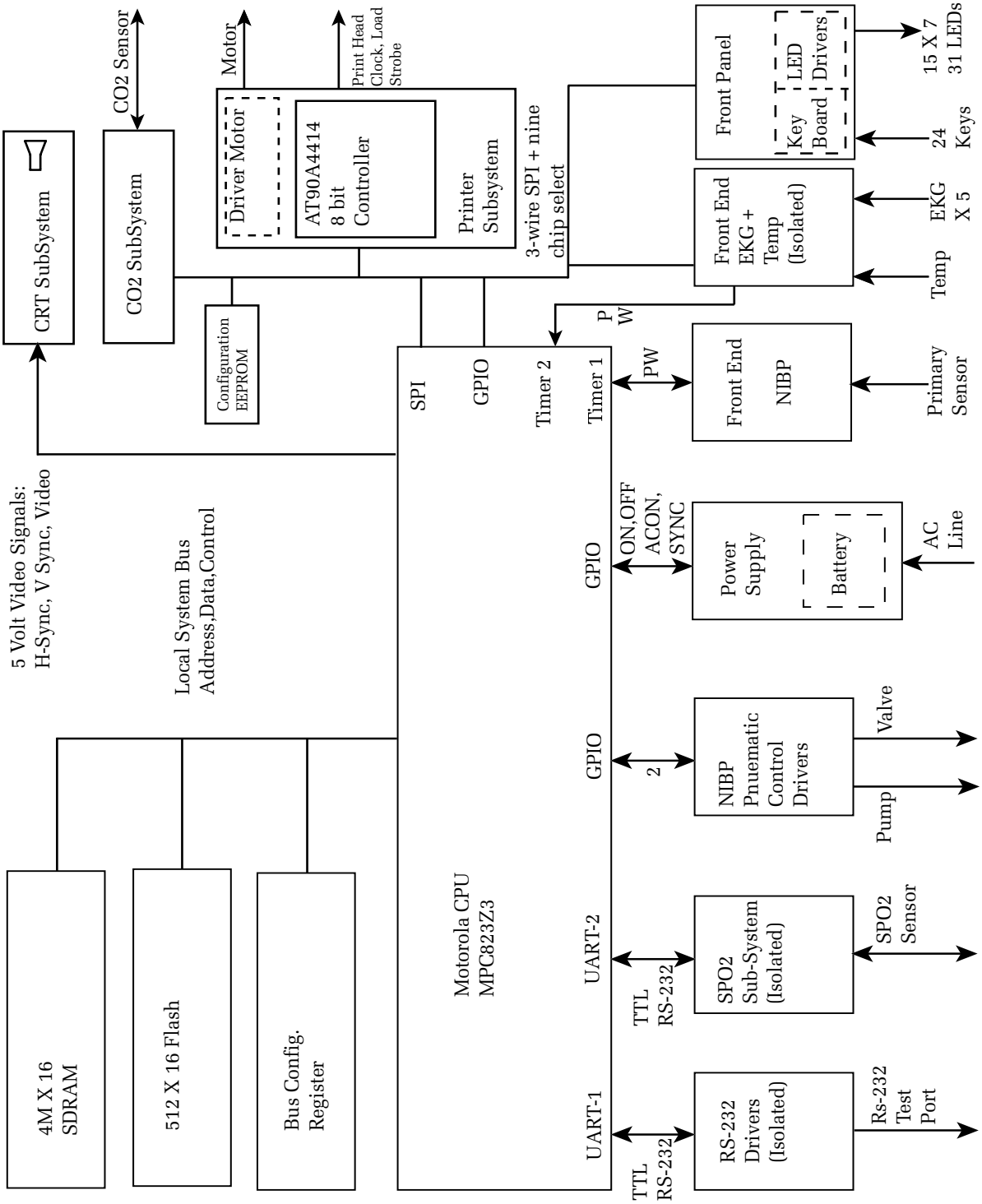
NOTE: *The **Print on alarm** function in **Advanced configuration** mode screen is only available with software version **BB.2.2000** and higher.*

NOTE: *On models 621S0 and 621N0 delete the **Print test pattern** function in the **Service Mode Screen**. Model 622S0 and 622N0 do not come with printers.*

* ***NOTE:*** *The **Display A/D channels** function in the **Service Mode Screen** only allows you to view system information by pressing the **SET** button. It does not allow you to change system settings.*

Atlas System Block Diagram

Figure 1-4. Atlas System Block Diagram



Incoming Inspection

NOTE: *Use the following guidelines when unpacking the monitor from its shipping carton.*

1. Before opening the monitor shipping carton, check for damage.

2. If damage is apparent, stop unpacking the carton and contract the shipping company for further instructions. If the carton is intact, unpack the monitor.

3. With the monitor out of its carton, check to see that all the items listed on the packing slip are in the shipping carton. See table 2-1 below.

Table 2-1. Atlas Packing List.

Qty.	Description	
1	Warranty card	
1	Adult Durable 1pc. Cuff	
1	Large Adult Durable 1pc. Cuff	
1	5ft. Straight Hose	
1	ECG Patient Cable (Three Lead)	
3	ECG Lead Wires	
1	SpO_2 Sensor/ Finger Clip	
1	$ETCO_2$ Water Trap	623 only
1	$ETCO_2$ Scrubber	623 only
1	Nasal Canula	623 only
1	Atlas Monitor	
1	Detachable Power Cord	
1	Printer Paper Roll	
1	Operation Manual	
1	Skin Temperature Probe	622/623 only

4. If an item is missing, first check the carton, then check with your receiving department. If necessary contact Welch Allyn at the address and phone number shown on Section 1.

5. Clean and disinfect by following the instructions printed in the Operator Manual.

NOTE: *Perform all functional tests as listed in Section 3 before and after servicing. Operate the Atlas to verify the customer complaint before making any changes to the unit. Call the customer if the complaint is unclear.*

If the unit has caused or is suspected of having caused an injury of any type: DO NOT DISASSEMBLE OR REPAIR THE UNIT IN ANY WAY. Contact Welch Allyn Customer Service immediately.

Calibration and Maintenance Schedule

The Atlas Monitor must be serviced by authorized Welch Allyn personnel or agents at 6 month intervals. Maintenance requirements are specified for 6 month and 12 month service intervals. The monthly CO_2 Reset operation can be performed by the user.

Service Interval	Maintenance Requirements
Every 6 months:	CO_2 Calibration
Every 12 months:	BP calibration, CO_2 reset, battery voltage calibration, printer adjustment,and temperature calibration. Complete functional test

Table 2-2. Tools Required for Service.

Description	Part#	Company
100cc Test Volume	T-112189	Welch Allyn
500cc Test Volume	T-112854	Welch Allyn
T-10 TORX screwdriver	XTD-10	Xcelite brand
7/16" deep socket for Temperature Port nut		Generic 1/4" drive
Squeeze Bulb and Valve	5088-01	Welch Allyn
Calibrated Manometer (0-10PSIG)	Digimano 1000	Netech
Bio-Tek (NIBP TESTER)	BP Pump	Bio-Tek
Pneumatic Tubing	5200-19	Welch Allyn
Pneumatic Tubing (coiled)	5200-19M	Welch Allyn
"Y" Fitting "Optional"	9586TPK4	Welch Allyn
"T" Fitting (3)	9858TPK4	Welch Allyn
Nonin Patient Simulator	8000S	Nonin
Nonin Cable	5200-52	Nonin
Calibrated Thermometer for 90F to 115F range	1002-3FC	ERTCO
LG, Adult Cuff/Bag	5200-02	Welch Allyn
Nellcor Patient Simulator For atlas with "MP 204/205 SpO2 PCB ONLY "	SRC-2	Nellcor
Nellcor Patient Simulator "MP 506 PCB ONLY "	SRC-MAX	Nellcor
Nellcor Sensor Cable "Purple Connectors" will work on all Atlas units with 204/205/506 SpO2 PCB	DEC-8	Nellcor
Nellcor Sensor Cable "Gray Connectors" "For Atlas units with MP 204/205 SpO2 PCB only"	EC-8	Nellcor
ECG Simulator with Impedance Respiration	214B	DNI Nevada
ECG Patient Cable (5 lead AHA)	6200-02	Welch Allyn
ECG Patient Cable (5 lead IEC)	6200-04	Welch Allyn
ECG leads, 5 Lead (IEC)	6200-08	Welch Allyn
ECG leads, 5 Lead AHA	6200-06	Welch Allyn
Certified Gas "10% CO2,10% O2, balance N2"	0304724SRBD	Scott Medical Products
ETCO2 Water Trap (package of 5)	6200-20	Welch Allyn
ETCO2 Scrubber	6200-21	Welch Allyn
ETCO2 Adult Nasal Sample Line	6200-22	Welch Allyn
Surface Sensor, Temperature	6200-15	Welch Allyn
Atlas Repair and Calibration Software	620538	Welch Allyn
Printer Paper - Case	6200-40	Welch Allyn
Digital Multimeter with 10mV accuracy on a 10V scale; 10A Range		
Adjustable DC power supply 5A @ 7V		
Battery cable assembly	620174-1	Welch Allyn
Atlas interface cable to PC	6200-60	Welch Allyn
PC with Windows 95 and above and with HyperTerminal serial port software	Part of Windows 95 & above	
1/4" Mono Phono Jack		
1000 Ohm precision resistor 1%		
1200 Ohm precision resistor 1%		
1350 Ohm precision resistor 1%		
1540 Ohm precision resistor 1%		
1870 Ohm precision resistor 1%		

Setting Date and Time

NOTE: *Check date and time before doing any calibration. Set date and time if incorrect. Set time and date as follows;*

1. Turn Atlas on.

2. Press **CLOCK** button next to power on button to check date and time. Use the far right **SELECT** button to scroll. Highlight the date or time that needs changed.

3. Press the **SET** button to adjust date and time.

4. Press **CLOCK** button to exit.

Pangea Communication Protocol

The Pangea Communication Protocol allows interaction of the Atlas with the computer through the serial interface port. A prompt is emitted at the computer screen when the instrument powers up and is ready to accept commands. The prompt is **Pangea>**. A prompt is emitted after the completion of each pangea command. Pangea commands are case sensitive. They are in English only.

B**P Calibration**

Required material.

1. 500cc vessel
2. Squeeze bulb with one-way valve
3. PC with HyperTerminal
4. Calibrated digital manometer
5. Tubing and T fittings
6. Serial cable

NOTE: *To start HyperTerminal you must have Windows*7 *95 or higher installed on your computer.*

1. From the Windows main screen follow the following sequence:
   Start ⇨Programs ⇨ Accessories ⇨ Communication ⇨ HyperTerminal

2. HyperTerminal setting are:
   9600 baud rate, 8 bit word, 1 stop bit
   no parity, no flow control
   ANSI character set

3. When you open HyperTerminal you will see a screen similar to the example in Figure 2-1. You will be prompted for a connection description. Choose any name. After you type in a name click **OK**.

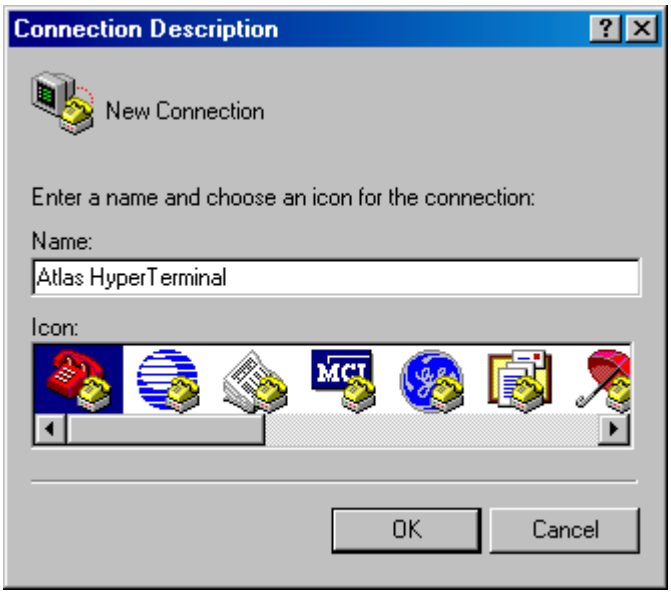


Figure 2-1. Example of a new HyperTerminal connection.

4. The next window you will see will be the window as shown in Figure 2-2. Click on **Connect using** then click on **COM1.**

Figure 2-2. Choosing COM1 in HyperTerminal.

5. Set the port settings as shown in the example in Figure 2-3. Now click **OK**.

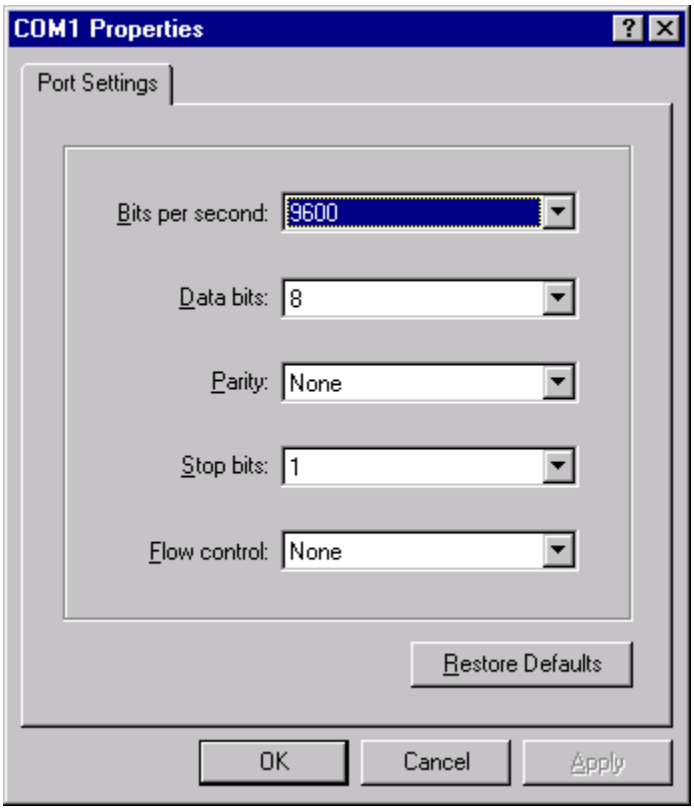


Figure 2-3. HyperTerminal Port Settings.

6. Connect the pressure meter, bulb, and 500cc vessel to BP port with “T” connectors as shown in photograph Figure 2-4.

7. Connect the Atlas to PC with serial cable.

8. Turn the Atlas on. Start HyperTerminal on PC. Press the <Enter> key and you should see a **Pangea>** prompt.

NOTE: *Take no more than 3 minutes for the 50mmHg calibration nor more than 3 minutes for the 250mmHg calibration as the Atlas will automatically, as a safety feature, open the blood pressure valve. If this happens you will have to turn the Atlas off then back on again and restart the calibration again.*

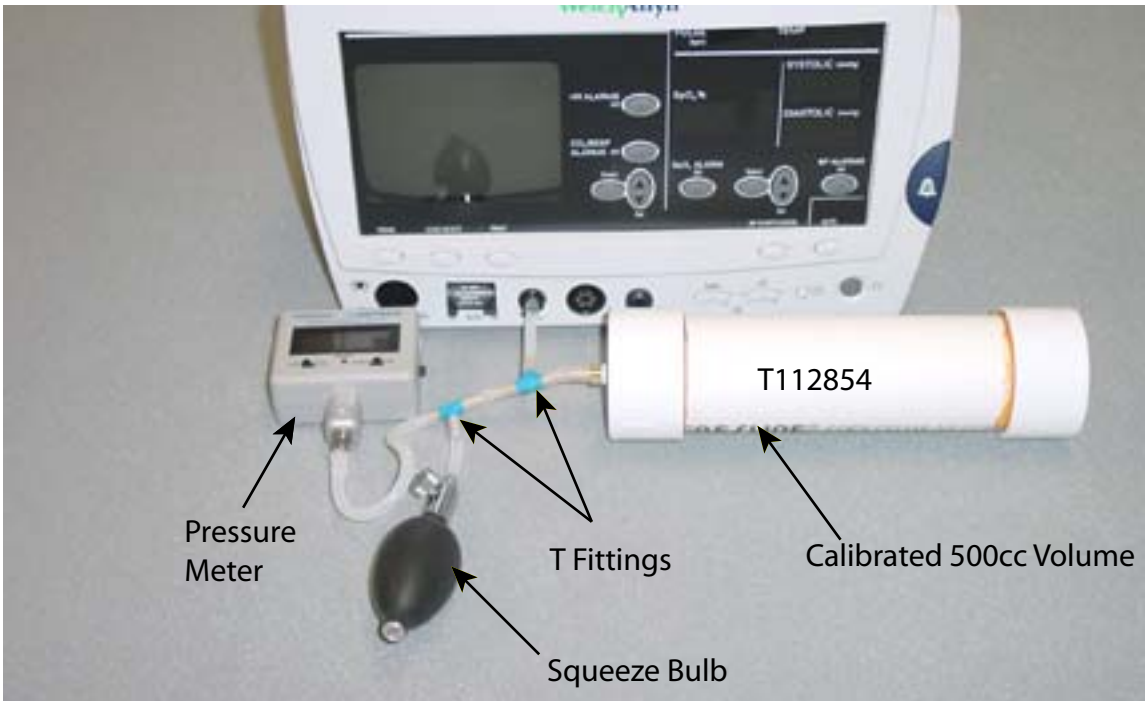


Figure 2-4. Photo of Atlas BP calibration setup.

50mmHg Calibration

1. Enter the following commands at the Pangea prompt.
   Pangea> **bp valve close** <ENTER>
   Pangea> **bp safety off** <ENTER>
   Pangea> **bp cal 5000** *Do not press <ENTER> yet!*

2. Raise the pressure with bulb to as close to 50.00mmHg as possible. Now press <ENTER>.

3. Release the pressure.

250mmHg Calibration

1. Enter the following command
   Pangea> **bp cal 25000** *Do not press <ENTER> yet!*

2. Raise the pressure with bulb as close to 250.00 mmHg as possible. Now press < **ENTER** >

3. Enter the following command to save the calibration in the Atlas.
   Pangea> **nvram write** <ENTER>

4. Release the pressure.

CO_2 Reset (623xx Models Only)

Required material. 1. Watertrap
2. Scrubber

NOTE: *The Scrubber looks similar to a watertrap, but it is filled with white granules. The scrubber is included with the 623XX models only.*

NOTE: *Make sure date and time are correct before performing the CO_2 reset.*

1. Turn Atlas on. Make sure the watertrap and scrubber are ***NOT*** attached to the Atlas.

2. Press the **DATE/TIME** button on the lower right of the monitor. The Set Date and Time and Other Options menu will be displayed.

3. Press the **CO_2/RESP ALARMS Off** button. The CO_2 Reset screen will appear.

4. You will see the following messages on the CRT.
   "**CO_2 Reset**"
   "Install CO_2 scrubber"
   "Press Trend to abort"

5. Install the watertrap to the Atlas. Install the scrubber to the watertrap.

6. You will see the following instructions on the screen.
   "**Warming up**" will be flashing on CRT.
   "**May take up to five minutes**" on CRT.
   "**Press Trend to abort**" on CRT.

7. After about 5 minutes you will see on the CRT.
   "**CO_2 Reset**"
   "**Reset complete**"
   "**Remove CO_2 scrubber**"
   "**Press the trend button to exit**"

8. Remove the CO_2 watertrap and scrubber.

9. Press **TREND** button to return to idle screen.

Replace watertrap after every six hours of use. Treat watertrap and used CO_2 sample lines as bio hazard material!

ET CO_2 Calibration

Required material:

1. Tank of approximately 10% CO_2, balance N_2 (certified) Blood Gas Mixture.
2. Tubing and T connectors.
3. Watertrap and scrubber.

1. Make sure the watertrap and scrubber are not attached to the Atlas. Turn the Atlas on.

2. Place the instrument into the Service Mode by pressing the **DATE/TIME** button. Make sure date and time are correct. Press the **LEAD SELECT** button.

3. Press **SELECT** button and scroll down to Calibrate CO_2.
   The message "**Install CO_2 Scrubber**" will appear on the right side of screen.

4. Attach the scrubber to the water trap.

5. Insert the scrubber/water trap assembly into water trap socket. The message "**Enter span gas value using Set button 10%**" will appear.

6. Press the **SET** button to change the value of span gas being used. The factory default value is 10%. Calibrate with a 8% to 12% certified CO_2 concentration known to be ±0.01%).

7. The message press "**BP Start/Cancel**" will appear at the bottom right of CRT. Press the **BP/Start/Cancel** button.

8. If you receive a "**Calibration Failed**" message at this point, check the date. If date is 2022 or above it will fail CO_2 calibration.

9. Next you will see a message "**Warming up**". After the Atlas warms up you will see a message "**Attach CO_2 gas**". Remove the scrubber from the CO_2 water trap. Do not remove water trap.

10. Attach the certified source of CO_2 gas to the CO_2 side-stream sampling tube as per Figure 2-5 below.

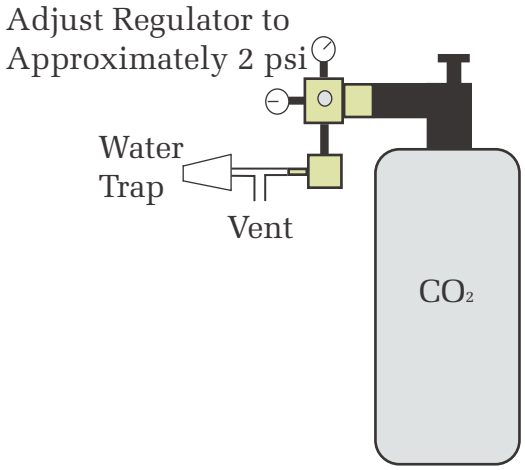


Figure 2-5. Example of CO_2 calibration setup.

CAUTION: IMPROPER USE,STORAGE OR HANDLING OF COMPRESSED GAS VESSELS CAN CAUSE DEATH OR INJURY. FOLLOW GAS MANUFACTURES SAFETY PROCEDURES!

11. Adjust the CO_2 regulator just enough to allow a small amount of gas to flow out of the vent (approximately 2 psi).

12. Press the **BP START/CANCEL** button. The message: "Sampling" will appear on CRT. "**CO_2 calibration successful**" or "**CO_2 calibration failed**" will appear on the CRT display.

13. Press the **TREND** button to exit.

No-Load Battery Voltage Calibration

NOTE: *No-Load Battery Voltage Calibration procedure is for models 622 and 623 only. If you disconnect the battery you must reset time and date after you reconnect the battery.*

Specifications: No load battery charge 6.85 VDC

Required materials: DVM

1. Remove the battery and disconnect the battery leads from the Atlas. Use the DVM to measure across the connectors, red+ and black-.

2. Adjust the voltage to 6.85 VDC by turning potentiometer R338, located behind the right battery jack. Turning clockwise will increase the no-load voltage and counter clockwise will decrease the no-load voltage.

Battery Voltage Calibration

Required materials.

1. DC power supply rated: 7 VDC at 5A
2. DMM / DVM with 10mV resolution on a 10 DC volt scale.
3. PC with HyperTerminal
4. Serial interface cable

1. Connect the serial cable to the PC and Atlas.

2. Hyper Terminal Settings are:
   9600 Baud, 8 bit word, 1 stop bit
   no parity, no flow control
   ANSI character set
   Find HyperTerminal in Windows 95 or higher
   Start ⇨Programs⇨Accessories ⇨ Communication⇨ HyperTerminal

NOTE: *Make sure the Atlas* ***IS NOT*** *plugged into AC for this calibration procedure.*

3. Remove and disconnect the battery from Atlas.

4. Set the power supply to 6.8VDC ± 200mV and connect the power supply to the battery connector on the Atlas.

5. Turn Atlas on..

6. Reduce the power supply to 6.0VDC and measure the voltage at the battery connector (at the Atlas) to the nearest 10mV.

NOTE: *Do not measure at the power supply, since cable resistance will introduce error.*

7. At the HyperTerminal prompt type:
   Pangea> **power cal XXXX** <ENTER>

NOTE: *XXXX represents the measured voltage in millivolts no decimal point. For example, if you measured 6.010VDC at the battery connector, use the command "****power cal 6010*** *<ENTER>".*

8. The Atlas will respond: raw = ZZZZ mV true = 6010 mV OK

NOTE: *ZZZZ is the raw uncalibrated reading that the instrument made.*

9. Reduce the power supply to 5.6 VDC. You should soon hear the "**low battery**" alarm.

10. Measure the voltage at the battery connector to the nearest 10mV.

11. At the HyperTerminal prompt type:
    Pangea> **power cal XXXX** <ENTER>

NOTE: *XXXX represents the measured voltage in millivolts with no decimal point. For example if you measured 5.590 volts at the battery connector, then you would enter the command "**power cal 5590**" <ENTER>.*

12. The Atlas will respond:
    raw = ZZZZmV true = 5590 OK

NOTE: *ZZZZ is the raw uncalibrated reading that the instrument made.*

13. Finish the calibration by typing:
    Pangea> **hw reset** <ENTER>

NOTE: *This will re-boot the Atlas.*

14. Turn the Atlas off and reinstall the battery.

15. Reset time and date.

Printer Print Adjustment

1. Install new paper.

2. Turn Atlas on.

3. Attach an ECG simulator to Atlas and set simulator for a heart rate of 60 bpm, normal sinus rhythm.

4. Press **PRINT** button. Evaluate the darkness of waveform and text printout.

5. If either need to be changed press **DATE/TIME** button then press **LEAD SELECT** button to access Advanced Configuration menu.

6. Press **SELECT** button and scroll down to Printer Test Pattern. Then Press **HR ALARMS OFF** button

7. Two lines will be displayed:
    1. Waveform+128
    2. Text+ 78

NOTE: *These two numbers are the factory defaults and are a good starting point if the system is printing poorly or not at all.*

8. The left **SET** button controls the waveform darkness and the right **SET** button controls the text darkness.

NOTE: *Pressing the **SET** button up will increase the number and darken the waveform while pressing the **SET** button down will decrease the number and will lighten the waveform.*

9. Make changes to the printout as needed.

10. Press **Trend** button to return to waveform screen.

Temperature Calibration

Required Material:

1. PC with Windows7 95 or higher
2. Atlas serial cable
3. 1k Ohm, 1/2 watt precision resistor
4. 1/4″ mono phono jack
5. Soldering iron and solder
6. Ohm Meter

1. Solder the 1 K Ohm resistor to 1/4” mono phono jack.

2. Measure the resistance at the tip of the phono jack. Record that resistance reading, to two decimal points.

3. Plug the phono jack into the Atlas.

NOTE: *The Atlas will show a temperature reading in the temperature display.*

4. Start HyperTerminal on PC.

5. Hyper Terminal Settings are:
   9600 Baud, 8 bit word, 1 stop bit
   no parity, no flow control
   ANSI character set
   Find HyperTerminal in Windows7 95 or higher
   Start ⇨Programs ⇨ Accessories ⇨ Communication ⇨ HyperTerminal

6. At the Pangea prompt Type: PANGEA> **temp cal XXXXXX** <ENTER>

NOTE: *XXXXXX is the resistance reading you measured and recorded in milliohms at the tip of the mono phono jack.*

Example: If you measure 1000.40 ohms at the tip of the phono jack then you would type **temp cal 100040** <Enter>.

7. Wait four seconds then type: PANGEA> **temp state** <ENTER>. You will see a value returned at the Pangea prompt.

8. Verify that the resistance given by the above command returns a value ± 0.5 ohms.

9. Verify temperature accuracy as outlined in Chapter 3, Table 3-2.

Calibration Date Set

NOTE: *After calibrating the Atlas you must reset the calibration date. The calibration date is the date you performed the calibration. The calibration date appears in the Service Mode menu. See Figure 2-6 for an explanation of the Service screen.*

1. At the Pangea prompt type.

   Pangea> **nvram set cal_date XXXX** <ENTER>

NOTE: *XXXX is the number of days from January 1, 1998 until the present date. See APPENDIX E for that number or calculate manually.*

Explanation of an Atlas Service Screen

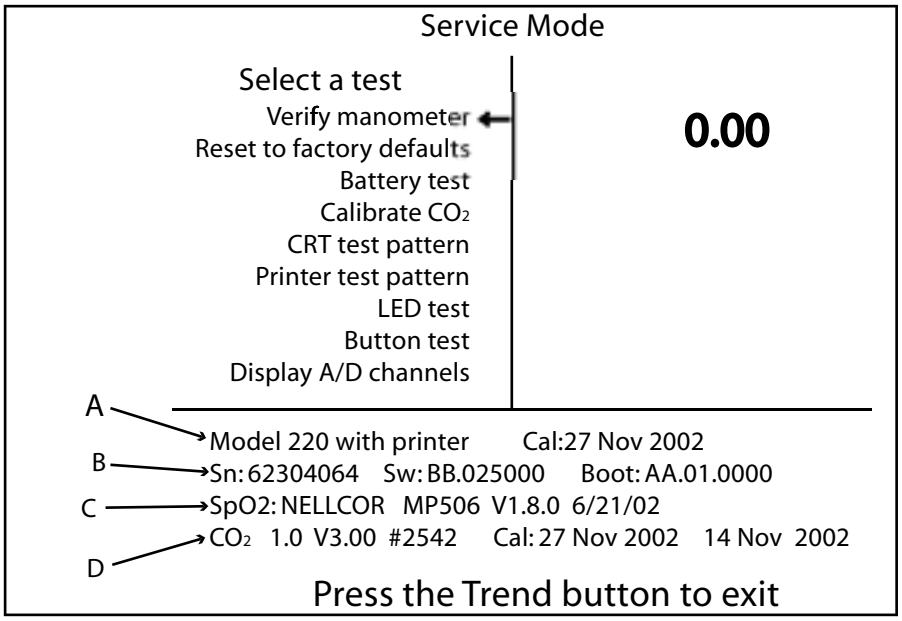


Figure 2-6. Example and Explanation of an Atlas Service Screen

Line A Indicates that the Atlas is a model 220 and that the Atlas has a printer. If the Atlas did not have a printer then the text "with printer" would be absent. The date field following indicates the date the Atlas was last calibrated.

Line B starts with a numeric sequence. The first three digits are the model number of the Atlas. The next five numbers are the Atlas serial number. The next sequence,alphanumeric, indicates what software version is currently loaded into the Atlas. The third sequence, alphanumeric, indicates what version boot software is currently loaded into the Atlas.

Line C starts with the SpO_2 OEM board used in the Atlas. There are two SpO_2 OEM boards used in the Atlas. One is Nellcor and the other is Nonin. The next sequence indicates the model of the SpO_2 board. The next sequence, that starts with a letter "V", is the version software used with the current SpO_2 board. The date following the SpO_2 software is the date the OEM loaded the software into the SpO_2 board. SpO_2 OEM software can not be upgraded. If the most current software is needed, you will need to replace the SpO_2 board.

Line D is the CO_2 information if your Atlas has CO_2 installed. *Only models 623 have CO_2 installed*. If your Atlas does not have CO_2 installed then line **D** will be absent. If your Atlas has CO_2 installed then line **D** will start with CO_2 followed by a numeric number. That numeric value is the software loaded into the CO_2 board. The next alphanumeric sequence, starting with a "V", is the version of that software. The next numeric sequence starting with a "#" is the serial number of the CO_2 board. The next sequence, a date, is the date the CO_2 was last calibrated. The last sequence, a date, is the date the CO_2 was reset. CO_2 OEM software can not be upgraded. If the current software is needed, you will have to replace the CO_2 board.

Table 2-3. Software Revision Table.

Model	Operating System	Boot loader	Nellcor	Nonin	Pryon
621S0	AA.01.4000, 9/8/99	AA.01.0000, 6/20/99		V7	
621S0	BB.02.0000, 4/4/01	AA.01.0000, 6/20/99		V7	
621S0	BB.02.2000, 6/4/02	AA.01.0000, 6/20/99		V7	
621S0	BB.02.5000, 10/14/02	AA.01.0000, 6/20/99		V7	
621N0	BB.02.5000, 10/14/02	AA.01.0000, 6/20/99	V1.8.1.0, 10/14/02		
621SP	AA.01.4000, 9/8/99	AA.01.0000, 6/20/99		V7	
621SP	BB.02.0000, 4/4/01	AA.01.0000, 6/20/99		V7	
621SP	BB.02.2000, 6/4/02	AA.01.0000, 6/20/99		V7	
621SP	BB.02.5000, 10/14/02	AA.01.0000, 6/20/99		V7	
621NP	BB.02.5000, 10/14/02	AA.01.0000, 6/20/02	V1.8.1.0, 10/14/02		
622S0	AA.01.4000, 9/8/99	AA.01.0000, 6/20/99		V7	
622S0	BB.02.0000, 4/4/01	AA.01.0000, 6/20/99		V7	
622S0	BB.02.2000, 6/4/02	AA.01.0000, 6/20/99		V7	
622S0	BB.02.2000, 6/4/02	AA.01.0000, 6/20/99		V7	
622S0	BB.02.5000, 10/14/02	AA.01.0000, 6/20/99		V7	
622SP	AA.01.4000, 9/8/99	AA.01.0000, 6/20/99		V7	
622SP	BB.02.0000, 4/4/01	AA.01.0000, 6/20/99		V7	
622SP	BB.02.2000, 6/4/02	AA.01.0000, 6/20/99		V7	
622SP	BB.02.5000, 6/14/02	AA.01.0000, 6/20/99		V7	
622N0	AA.01.4000, 9/8/99	AA.01.0000, 6/20/99	V 1.2.0.0 12/17/97		
622N0	BB.02.0000, 4/4/01	AA.01.0000, 6/20/99	V 1.2.0.0 12/17/97		
622No	BB.02.2000, 6/4/02	AA.01.0000, 6/20/99	V 1.2.0.0 12/17/97		
622N0	BB.02.5000, 10/14/02	AA.01.0000, 6/20/99	V 1.8.1.0 10/14/02		
622NP	AA.01.4000, 9/8/99	AA.01.0000, 6/20/99	V 1.2.0.0 12/17/97		
622NP	BB.02.0000, 4/4/01	AA.01.0000, 6/20/99	V 1.2.0.0 12/17/97		
622NP	BB.02.2000, 6/4/02	AA.01.0000, 6/20/99	V 1.2.0.0 10/14/02		
622NP	BB.02.5000, 10/14/02	AA.01.0000, 6/20/99	V 1.8.1.0 10/14/02		
623SP	AA.01.4000, 9/8/99	AA.01.0000, 6/20/99		V7	0.E V1.00
623SP	BB.02.0000, 4/4/01	AA.01.0000, 6/20/99		V7	0.E V1.00
623SP	BB.02.2000, 6/4/02	AA.01.0000, 6/20/99		V7	
622SP	BB.02.5000, 10/14/02	AA.01.0000, 6/20/99		V7	
623NP	AA.01.4000, 9/8/99	AA.01.0000, 6/20/99	V 1.2.0.0 12/17/97		0.E V1.00
623NP	BB.02.0000, 4/4/01	AA.01.0000, 6/20/99	V 1.2.0.0 12/17/97		0.E V1.00
623NP	BB.02.2000, 6/4/02	AA.01.0000, 6/20/99	V 1.2.0.0 12/17/97		
623NP	BB.02.5000, 10/14/02	AA.01.0000, 6/20/99	V 1.8.1.0 10/14/02		

Software Upgrade Procedure

NOTE: *The following procedures are required to upgrade the software on a fully functioning Atlas or to reload software after replacing the CPU board. The download utility "**atlas_dl.exe**" loads the following files automatically.*

1. *atlas.out.gz*
2. *nvram_common.txt*
3. *nvram_(model#).txt*
4. *nvram_(language).txt*

"Atlas_dl.exe" will also query the Atlas to determine what model number the Atlas is and what language to download.

Equipment or supplies required:

1. PC with Windows7 95 or higher
2. Atlas serial cable
3. File: atlas_dl.exe (Included in the Atlas Repair Software listed in Table2-2.)

NOTE: *Make sure you have HyperTerminal turned off or the following utility download will not work!*

1. Run the program **atlas_dl.exe** from the CD or copy the file to your hard drive and run the program from there.

2. Connect the serial cable between the Atlas and the PC s'"COM1 port".

3. Turn your computer on and locate the "atlas_dl.exe" file.

4. Double left click on the "atlas_dl.exe" file.

5. When the file starts to download, the CRT will go blank on the Atlas.

NOTE: *Do not use the computer while the program is downloading.*

6. After down loading is complete, check all alarm settings and all user advanced configuration settings since these are ***RESET*** by this utility software download procedure.

NOTE: ***Stop here*** *if you are just upgrading software on a fully functional Atlas monitor or if you have replaced the CPU board.*

NOTE: *If you have replaced the **MAIN BOARD** then you **MUST** continue with the next procedure (**DOWNLOADING NVRAM FILES**).*

NOTE: *Perform the following NVRAM downloading procedure if you have replaced the MAIN BOARD. The NVRAM resides on Main Board.*

Down Loading NVRAM Files

Required Materials.

1. Computer with Windows7 95 or higher.
2. The latest Atlas repair software. Call your local Welch Allyn representative.

1. Once you have procured the latest Atlas Repair Software, you will be able to run the programs straight from the CD or copy the files to your hard drive.

NOTE: *Through HyperTerminal you will need to load the following files:*

1. nvram_cal_init.txt
2. nvram_common.txt
3. model# of Atlas
3.1. You will load "nvram200.txt" if your Atlas is a model 621xx.
3.2. You will load "nvram210.txt" if your Atlas is a model 622xx.
3.3 You will load "nvram220.txt" if your Atlas is a model 623xx.
4. "language.txt" Any combination of or all of the following files
4.1 "nvram_english.txt" for the English language
4.2 "nvram_french.txt" for the French language
4.3 "nvram_german.txt" for the German language
4.4 "nvram_spanish.txt" for the Spanish language
4.5 "nvram_potuguese.txt" for the Portuguese language
4.6 "nvram_italian.txt" for the Italian language
4.7 "nvram_chinese.txt" for the Chinese language
4.8 "nvram_japanese.txt" for the Japanese language
5. printer.txt (if fitted with a printer), or no_printer.txt. (if not fitted with a printer)

NOTE: *After loading the preceding files you, must then type the following commands at the Pangea prompt.*

1. "nvram set serial xxxxx" where xxxxx is the serial number of the Atlas monitor.
2. "nvram write" writes the information to memory.
3. "hw reset" performs a hardware reset.

2. Connect the serial cable between the Atlas and the PC COM1 port.

3. Open HyperTerminal program on PC.
   Hyper Terminal Settings are:
   9600 Baud, 8 bit word, 1 stop bit
   no parity, no flow control
   ANSI character set
   Find HyperTerminal in Windows7 95 or higher
   Start ⇨Programs ⇨ Accessories ⇨ Communication ⇨ HyperTerminal

4. Turn Atlas on. You should see the Pangea prompt. See example in Figure 2-7.

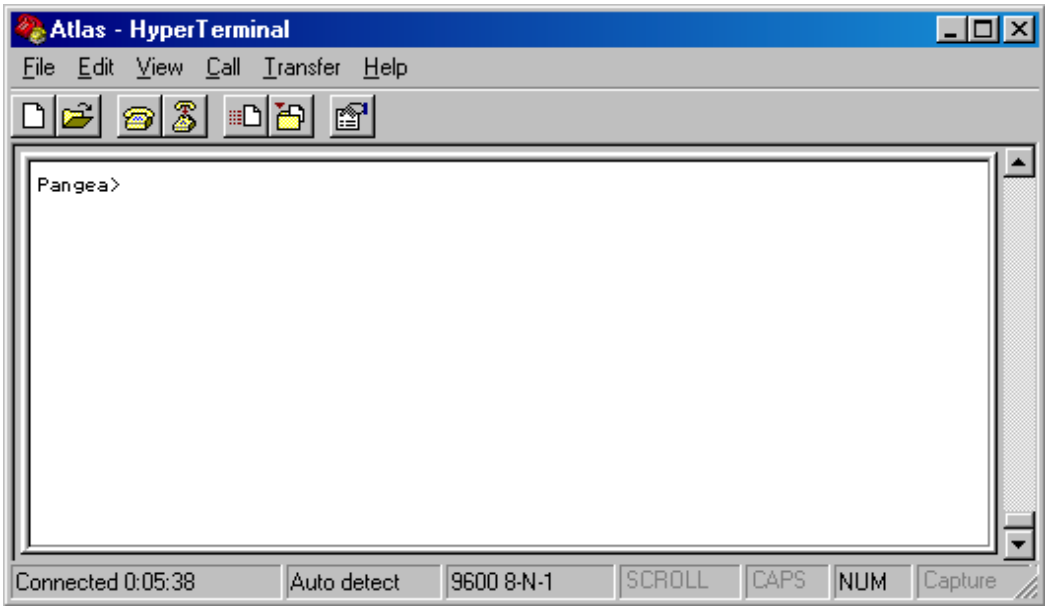


Figure 2-7. Pangea prompt in HyperTerminal.

5. Scroll over to "**Transfer**" and then scroll down and choose "**Send Text File**". See example in Figure 2-8.

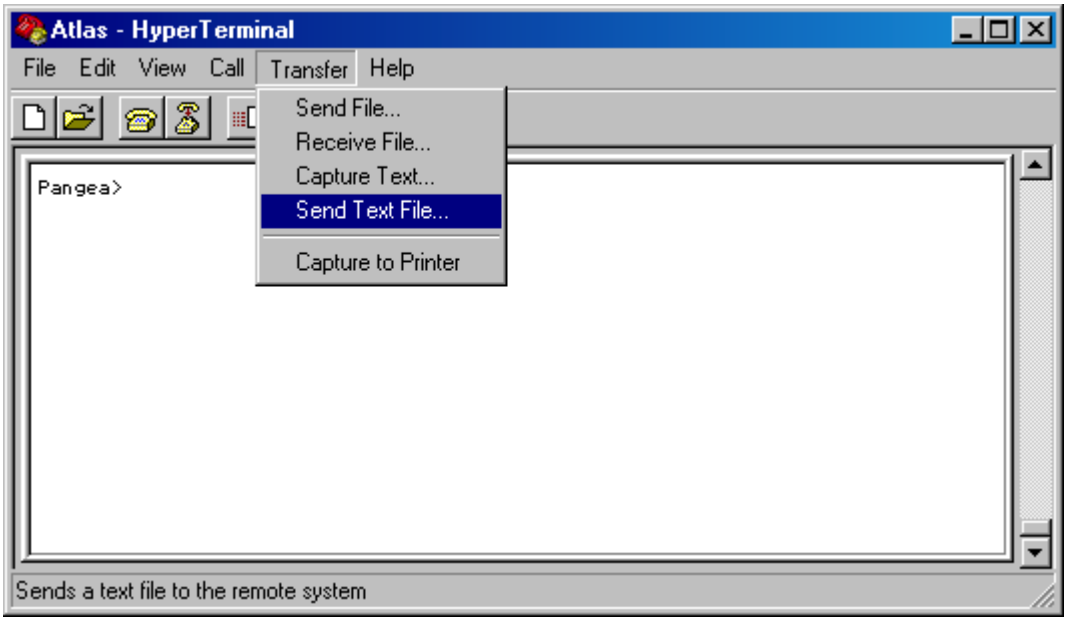


Figure 2-8. Choosing "Send Text File" in HyperTerminal.

6. Another window will then appear and prompt you for the location of the files. Double left click on that folder to open that directory. You can also run these programs from the CD. See example in Figure 2-9.

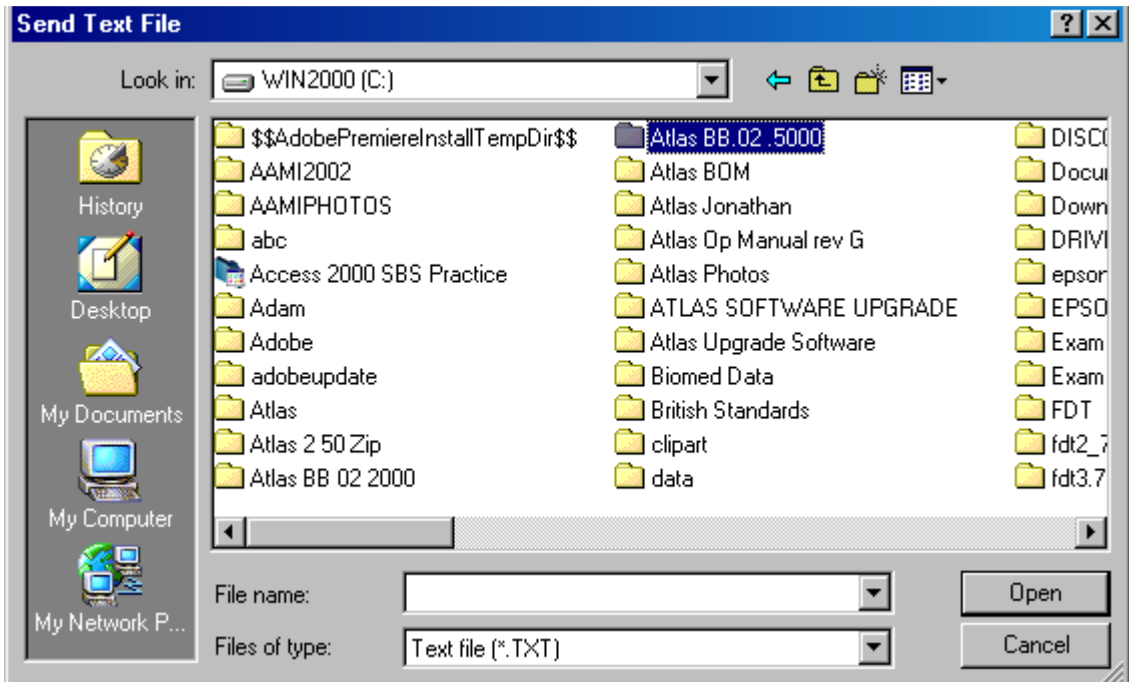


Figure 2-9. Choosing directory where NVRAM files are stored.

7. Once the folder is open, open the file "**nvram_cal_init.txt"** file by double left clicking on that file or by high lighting the file and then click on the **Open** button. See example in Figure 2-10.

*Remember that after you have download the files in this section and you **must** complete this entire "**Downloading NVRAM files**" section, that you **must** perform a complete calibration on the Atlas monitor.*

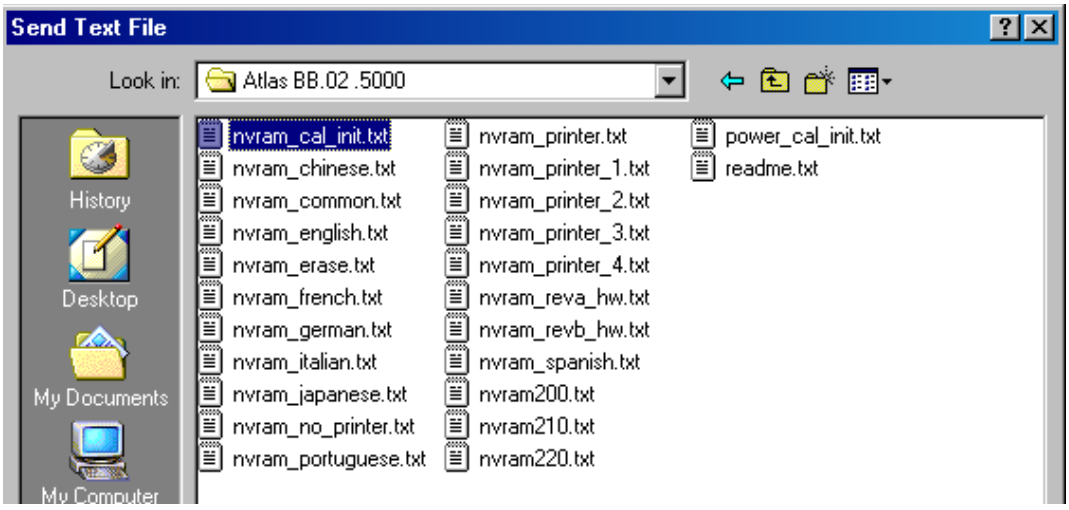


Figure 2-10. Choosing the nvram_cal_init.txt file.

NOTE: *After the* ***nvram_cal_init.txt*** *has executed you should see a Pangea screen similar to window as shown in Figure 2-11.*

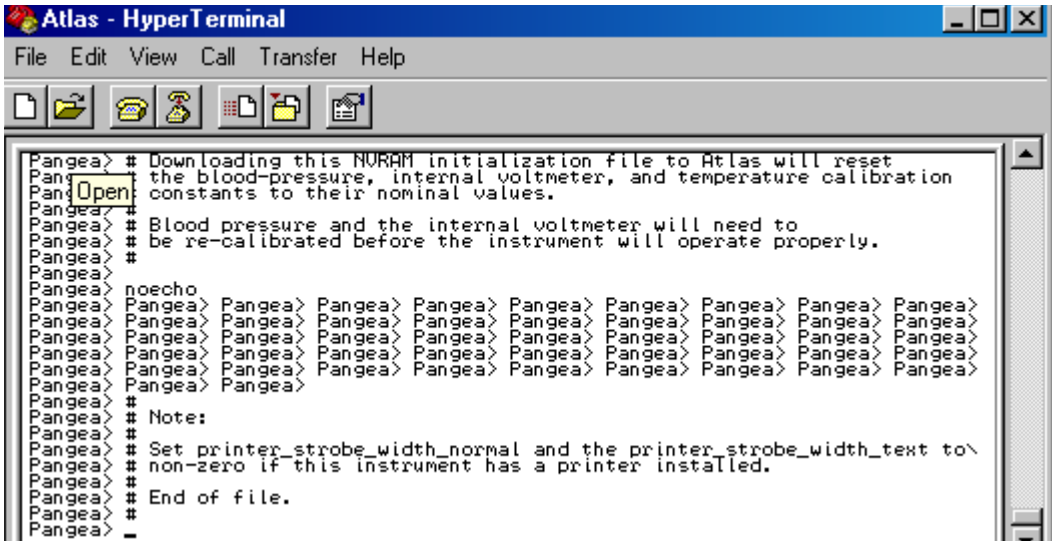

Atlas - HyperTerminal
File Edit View Call Transfer Help
Pangea> # Downloading this NVRAM initialization file to Atlas will reset
Pangea> # the blood-pressure, internal voltmeter, and temperature calibration
Pangea> # constants to their nominal values.
Pangea> #
Pangea> # Blood pressure and the internal voltmeter will need to
Pangea> # be re-calibrated before the instrument will operate properly.
Pangea> #
Pangea>
Pangea> noecho
Pangea> # Note:
Pangea> # Set printer_strobe_width_normal and the printer_strobe_width_text to\
Pangea> # non-zero if this instrument has a printer installed.
Pangea> # End of file.

Figure 2-11. Pangea screen after opening the **nvram_cal_init.txt** file.

8. From your pangea window choose **Transfer** then choose **Send Text File**.

9. Open the directory where the file **nvram_common.txt** is located or open from the CD.

10. Double left click on **nvram_comm.txt** file or highlight the file and then choose **Open**.

NOTE: *After opening the* ***nvram_common.txt*** *file you should see a screen similar to the window shown in Figure 2-12.*

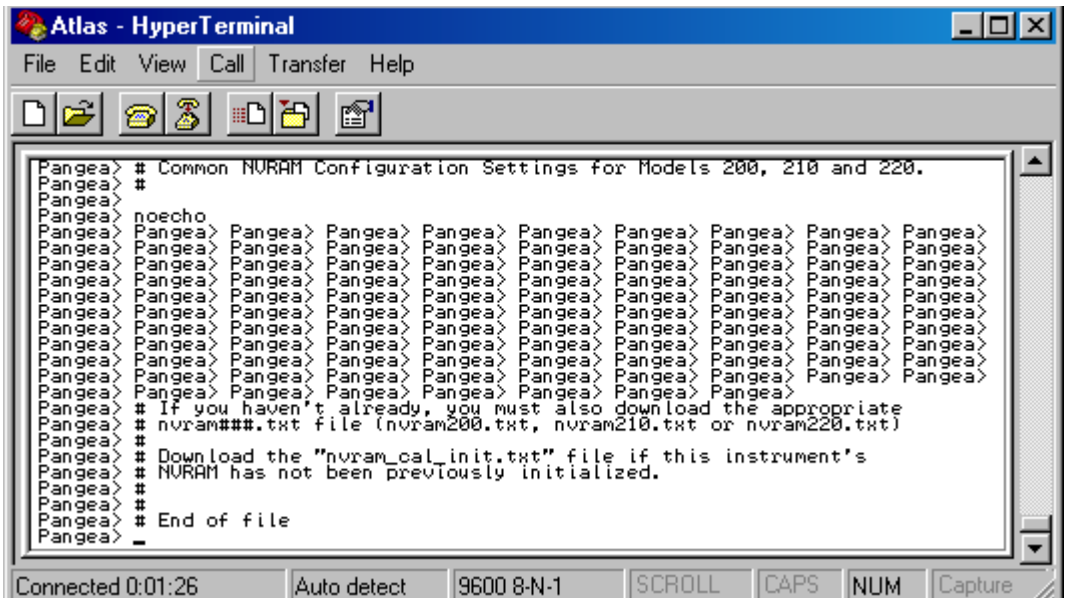

Atlas - HyperTerminal
File Edit View Call Transfer Help
Pangea> # Common NVRAM Configuration Settings for Models 200, 210 and 220.
Pangea> #
Pangea>
Pangea> noecho
Pangea> # If you haven't already, you must also download the appropriate
Pangea> # nvram###.txt file (nvram200.txt, nvram210.txt or nvram220.txt)
Pangea> #
Pangea> # Download the "nvram_cal_init.txt" file if this instrument's
Pangea> # NVRAM has not been previously initialized.
Pangea> #
Pangea> #
Pangea> # End of file
Connected 0:01:26
Auto detect
9600 8-N-1
SCROLL
CAPS
NUM
Capture

Figure 2-12. Pangea screen after opening the nvram_common.txt file.

NOTE: *Next you will download the model# of the Atlas by choosing* ***only*** *one of the three following files.*

1. *If you have an Atlas model 621 then you will* ***only*** *download the file* ***nvram200.txt.***
2. *If you have an Atlas model 622 then you will* ***only*** *download the file* ***nvram210.txt.***
3. *If you have an Atlas model 623 then you will* ***only*** *download the file* ***nvram220.txt.***

11. Open the directory where the model number files are located or open from CD.

12. Open the file by double left clicking on the file that represents the model number of the Atlas you are working on or highlight that file then choosing **Open**.

NOTE: *After opening the Atlas model# file you should see a Pangea screen similar to the window as shown in Figure 2-13.*

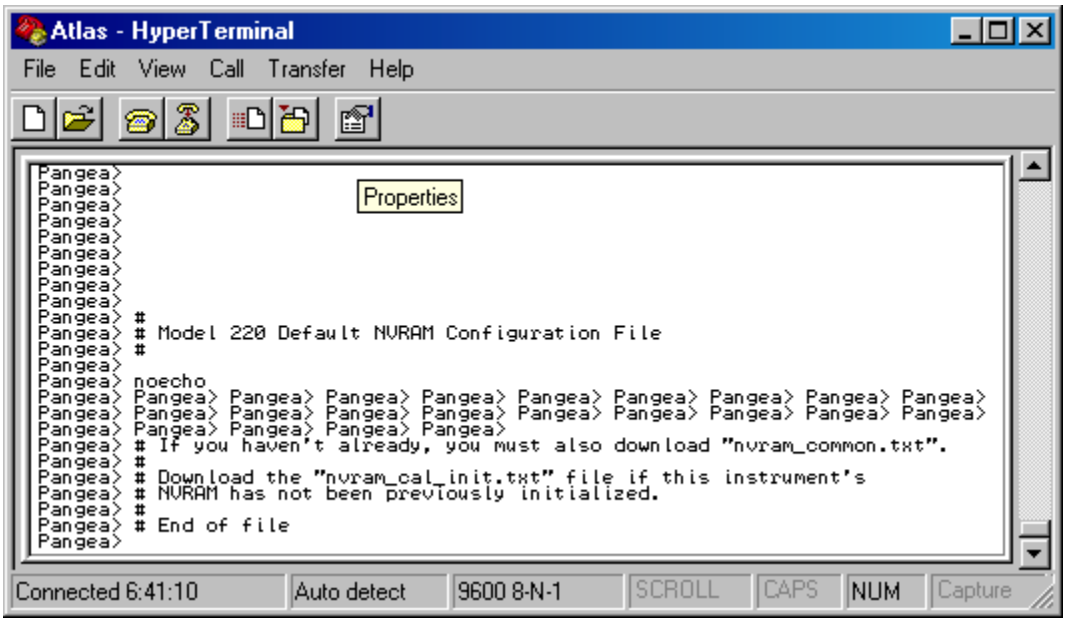


Figure 2-13. Pangea prompt after opening the model# file.

NOTE: *Next you will download the language(s) that you want the Atlas to store in it's Advanced Configuration menu for languages. You can have one or all the languages loaded in the Atlas. Listed in Table 2-4 are the language(s) choices and the files you will need to download to have the language(s) loaded in the Atlas. Each language you want loaded in the Atlas will require that the file associated with that language be loaded.*

Table 2-4. Files needed to download language(s).

Language	File needed to download
English	nvram_english.txt
French	nvram_french,txt
Spanish	nvram_spanish.txt
German	nvram_german.txt
Portuguese	nvram_portuguese.txt
Italian	nvram_italian.txt
Chinese	nvram_chinese.txt
Japanese	nvram_japanese.txt

13. Open the directory where the language files are located or open from CD.

14. Double left click on language.txt file or highlight the file and then choose **Open**.

NOTE: *After you download a language.txt file you should see a Pangea screen similar to Figure 2-14.*

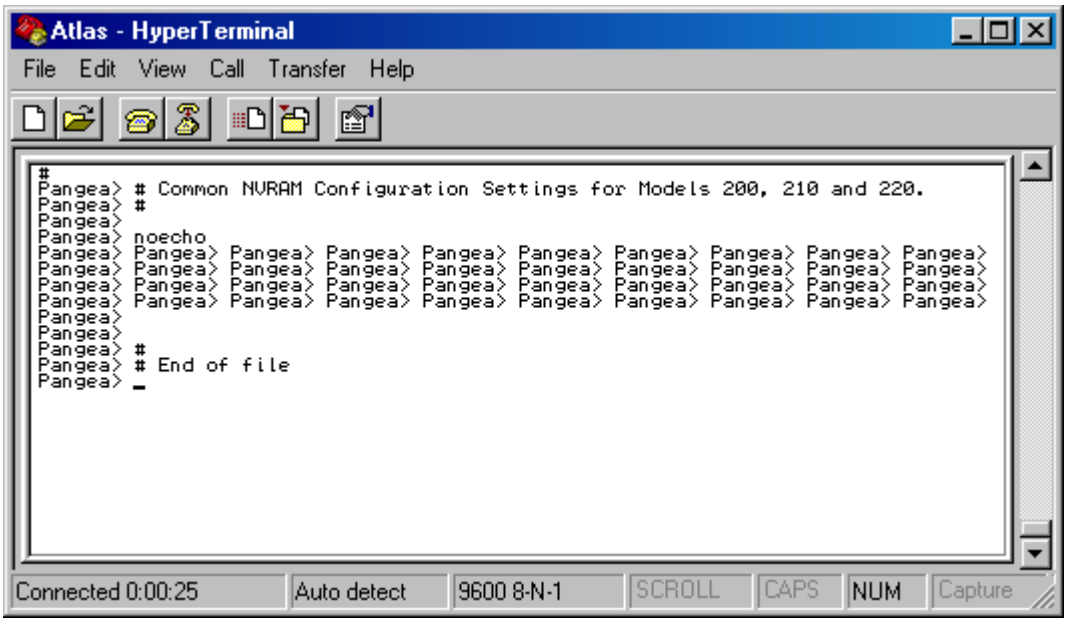


Figure 2-14. Pangea screen after loading a language file.

NOTE: *Next you tell the Atlas if it does or does not have a printer.*

1. *If the Atlas has a printer you will download the file* ***nvram_printer.txt****.*
2. *If the Atlas does not have a printer then you will download the file* ***nvram_no_printer.txt****.*

15. Open the directory where the printer.txt files are located or open from CD.

16. Double left click on the printer file or the no_printer file or highlight the printer file or the no_printer file and then choose **Open**.

NOTE: *After you have downloaded the printer or no_printer file you should see a Pangea screen similar to the window as shown in Figure 2-15.*

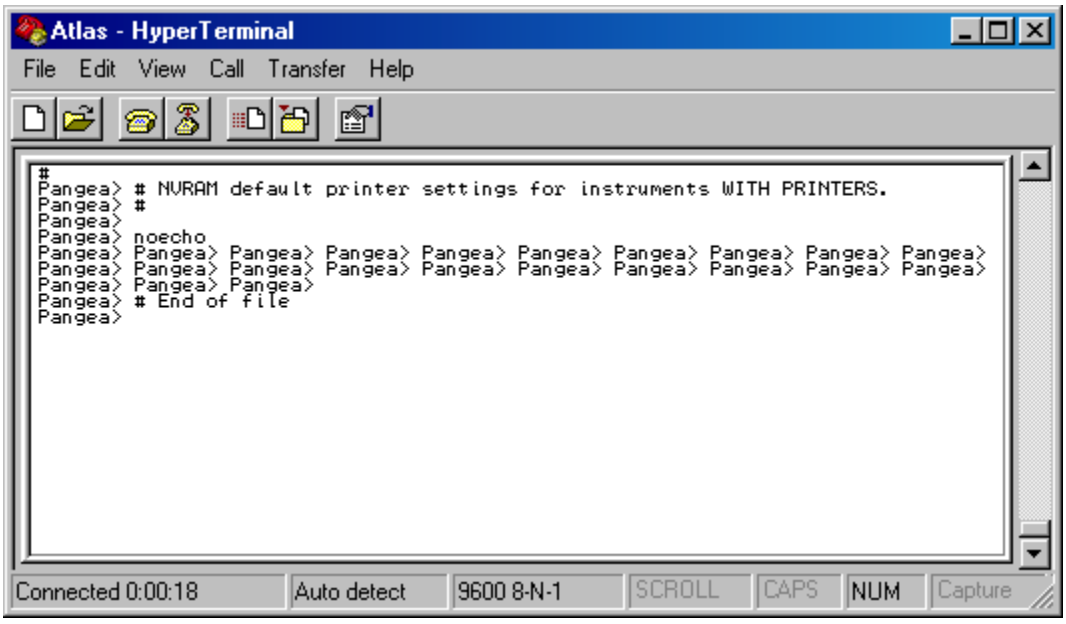


Figure 2-15. Pangea screen after downloading the nvram_printer.txt file.

NOTE: *The next three commands will require that you actually type the command at the Pangea prompt.*

NOTE: *XXXXX on line 17 is the Atlas 5 digit serial number. The serial number is located on the bottom of the Atlas. Make sure that you have a space between the command* ***serial*** *and the five numbers you are entering.*

17. At the Pangea prompt type the following command **"nvram set serial XXXXX"**<ENTER>

NOTE: *After you have typed the* ***nvram set serial XXXXX*** *command and hit* ***ENTER*** *you should see a Pangea screen similar to the example in Figure 2-16.*

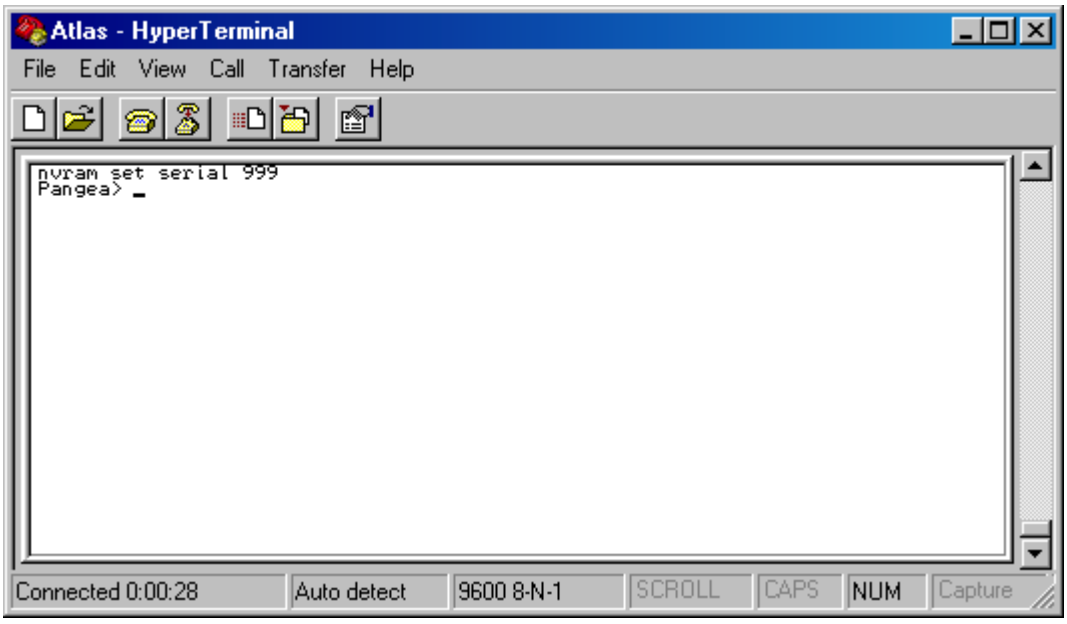


Figure 2-16. Pangea screen after you have downloaded the nvram set serial command.

NOTE: *To finish downloading the NVRAM files, type the next two commands at the Pangea prompt.*

18. At the Pangea prompt type the command **nvram write** <ENTER>.

19. At the Pangea prompt type the command **hw reset** <ENTER>.

NOTE: *The **hw reset** command will reboot the Atlas.*

*Remember that after you have download the files in this section and you **must** complete this entire "**Downloading NVRAM files**" section, that you **must** perform a complete calibration on the Atlas monitor.*

NOTE: *The firmware is not up grade able on the OEM boards (SpO_2 and CO_2) boards. If a higher version software is needed, then you will need to replace the OEM board.*

NOTE: *Review customer complaint and determine if it is safe to plug in the Atlas monitor into AC power and if it is safe to turn on!*

Power on Self Test

1. Plug in Atlas into AC power with no sensors attached. Verify that the *AC~ LED* indictor is lit. Install paper in printer if fitted.

2. Turn on power and verify the following:
    1. Green light in power button.
    2. Loud beep when **Power On** button pressed.
    3. Three dashes in SYSTOLIC.
    4. Three dashes in DIASTOLIC.
    5. Two dashes in SpO_2 (takes several seconds after BP dashes come on).
    6. Three dashes in PULSE (takes several seconds after BP dashes come on).
    7. Single bar at the bottom of Plethysmograph.
    8. No lights in TEMP.
    9. No lights in ALARMS OFF buttons.
    10. X lit on AUTO.
    11. CRT display may comes on slowly if cold or quickly if still warm from last use.
    12. May see version string in center if comes on quickly. It is not a problem if not seen because it comes on slowly.

3. On the CRT you should see:
    1. Three dashes for Heart Rate
    2. Heart symbol
    3. Lead select symbol
    4. Scale bar
    5. One or two lines of dashes for waveforms – depends upon settings.
    6. Three dashes for MAP – or blank, depending upon settings.
    7. Error message(s) at bottom of screen?

4. On models 622 or 623, disconnect AC cable. You should see no change except the *AC~ LED* indicator will not be lit. If you see warnings of a low, very low or depleted battery, or if the system turns off by it's self, plug the Atlas back into the AC outlet and let the unit charge with unit turned off. Repeat test in 2 hours.

5. Plug the monitor back into AC.

Menu Functional Test

1. Press **DATE/TIME** button to enter menu page. Press **TREND** button to access the Advanced Configuration menu.

2. Write down all configuration settings so that they can be reset to customer preferences later. If you have a printer press the **PRINTER** button to print out customer configuration settings.

3. Set language to your native tongue if necessary to allow you to write down the other settings. The top item is always the language, press either **SET** buttons to step through list.

4. Press **TREND** button to return to idle screen. Press **DATE/TIME** button and verify that date and time are correct. Set date and time if necessary.

NOTE: *An incorrect date may indicate a battery problem. If date was incorrect, turn off unit, disconnect AC power cable, wait 5 minutes then reconnect the power cable. Turn Atlas on. Check date again. If date comes back incorrect on model 621 then replace main board. On model 622 and 623, if battery was not dead then replace main board.*

5. Press **DATE/TIME** button to return to waveform screen if needed.

6. Press **DATE/TIME** button then press **LEAD SELECT** button to access service mode

7. Version/configuration data is in lower half of menu, write it all down.

8. Press **SELECT** button to highlight reset to factory defaults.

9. Press **BP START/CANCEL** button to reset configuration.

10. Press **TREND** button to return to idle screen.

11. Press **DATE/TIME** button then press **TREND** button to access the Advanced Configuration menu.

12. Set language to your native tongue if necessary

NOTE: *We have just reset the monitor to factory defaults. Compare settings to factory defaults appropriate for the country in Operator manual. If the factory defaults do not match then that may indicate a memory problem. Changing only the language should not change any of the other factory default settings.*

13. Press **DATE/TIME** button then press **LEAD SELECT** button to access service mode.

14. Press **SELECT** button to highlight CRT test pattern.

15. Press **BP START/CANCEL** button to show test pattern. Examine display. Press any key to end display.

16. Press **Select** button to highlight Printer test pattern (if fitted). Press **BP START/CANCEL** button to start test pattern. Printer should print a test pattern. Press any key to end display. Examine printout.

17. Press **SELECT** button to highlight LED test. Press **AUTO** button to turn on all LEDs. Press **BP START/CANCEL** button to show automatic test pattern. Watch for a while, look for glitches in pattern. Press **SET** button to go to manual mode and step through individual segments if needed to observe a problem.

18. Press **SELECT** button to highlight Button test. Press **BP START/CANCEL** button to start test. Press every button on system, press **BP START/CANCEL** button last. Verify that buttons match up with their names and that all buttons are functional.

NOTE: *If name does not correspond to the button pushed then this may indicate memory corruption. You may need to replace the main board.*

19. Press **SELECT** button to highlight Display A/D channels. Press **SET** button and write down all values for each of the four screens for later review. Press **TREND** button to return to Idle screen.

BP Test

1. Press **DATE/TIME** button then press **TREND** button to access the Advanced Configuration menu. Press **SELECT** button to highlight Initial pressure. Press **SET** button to change Initial pressure to 280 mmHg. Press **SELECT** button to highlight MAP. Press **SET** button to change MAP to Yes. Press **TREND** button to return to idle screen.

2. Connect the BP port to the BP simulator. Set the simulator for a normal reading (140/80, 100BPM, NSR). Press **BP START/CANCEL** button. Atlas should start to pump and display a manometer value in SYSTOLIC LED. This value should track and be very close to pressure displayed by manometer on BP simulator (if fitted). Largest number shown in SYSTOLIC LED should be very close to the initial pressure setting recorded above from Advanced Configuration. System should start stepping down pressure, showing step values in SYSTOLIC LED display. It then should display the correct SYSTOLIC and DIASTOLIC values. System may show MAP value depending upon country language setting.

3. Press **BP START/CANCEL** button. System should start pump, display manometer value in SYSTOLIC LED. This value should track and be very close to pressure displayed by manometer in BP simulator (if fitted). Largest number shown in SYSTOLIC should be very close to the Initial pressure setting of 280 mmHg. If pressure shown exceeds 300 mmHg then re calibrate the Atlas BP.

4. System should start to step down pressure, showing step values in SYSTOLIC LED and then display correct SYSTOLIC and DIASTOLIC values. System should show MAP value. MAP value should match what is shown by simulator.

5. Set simulator to (120/70, 60 (beats per minute)bpm, NSR).

6. Press the **AUTO** button. The X manual BP cycle indicator will go out and the 1 minute auto BP cycle indicator will flash for 10 seconds. 20 seconds after the 1 minute auto BP cycle indicator stops flashing, BP measurement starts.

7. Verify the BP reading. If BP measurement incorrect recalibrate.

8. No less than 30 seconds after completing the measurement another measurement should start. While it is pumping up, press the **BP START/CANCEL** button. Measurement should stop immediately and pressure should be dumped (as seen on the simulator manometer).

9. Press **AUTO** button and X manual BP cycle indicator should light (not flashing).

10. Disconnect the tubing from the BP port on the Atlas. Press **BP START/CANCEL** button and note the time (to the second) when the Atlas aborts the BP cycle and gives you an alarm. It should take no longer than 1 minute. Turn Atlas off.

Static Manometer Accuracy Test

Required materials.

1. Serial interface cable
2. PC with HyperTerminal (Windows 95 or above)
3. 500cc vessel with inflation system.
4. Calibrated manometer

1. Turn computer on and activate Hyper terminal.
   Hyper Terminal Settings are:
   9600 Baud, 8 bit word, 1 stop bit
   no parity, no flow control
   ANSI character set
   Start ⇨Programs ⇨ Accessories ⇨ Communication ⇨ HyperTerminal

2. Turn Atlas on. Refer to Figure 2.1 in Section 2 for inflation setup.

3. Enter the following commands at the PANGEA> prompt.
   PANGEA> **bp safety off** <ENTER>
   PANGEA> **bp valve close** <ENTER>

4. Pressurize the Atlas monitor to the applied pressures in Table 3-1.

5. To compare the applied pressure to the transducer readings use the following command.
   PANGEA> **bp press** <ENTER>

Table 3-1. Transducer pressure table.

Applied Pressure	Primary Transducer	Safety Transducer
0 mmHg	±0.75 mmHg	±1.0 mmHg
50 mmHg	±1.5 mmHg	±1.5 mmHg
150 mmHg	±1.5 mmHg	±4.5 mmHg
250 mmHg	±1.5 mmHg	±7.5 mmHg

6. Verify that the primary transducer and secondary transducer are within the specifications listed in Table 3-1.

NOTE: *The Atlas monitor will return a response to the computer screen as follows. If you tested at the 50mmHg pressure you would receive a message similar to: px = 5279, sx = 5305 x 0.01. Where px is the primary transducer and 5279 = 52.79 mmHg and sx is the secondary transducer and 5305 = 53.05 mmHg.*

BP Leak Test

NOTE: *Unit must not leak more than 5 mmHg in a 15 second interval while attached to a 100cc test cavity pressurized at 50 mmHg, 150 mmHg and 250 mmHg.*

Required Materials: 100cc test vessel (+10cc/-0cc), stopwatch, squeeze bulb, calibrated manometer.

1. Connect Atlas to 100cc test vessel and calibrated manometer as shown in Section 2, Figure 2.1.

2. Turn Atlas on.

3. Press **DATE/TIME** button then press **LEAD SELECT** button to access the Service Mode.

4. Press **SELECT** button and choose Verify manometer.

5. Pressurize the Atlas with squeeze bulb to 50mmHg and allow reading to stabilize.

6. Observe pressure for 15 seconds.

6. Unit should not leak more than 5mmHg during this time.

7. Repeat this process at 150mmHg and 200mmHg.

Over 15 mmHg Test

NOTE: *Atlas hardware must detect if the pneumatic system has been pressurized greater than 15 mmHg for more than 155 seconds but less than 180 seconds.*

Required Materials: 500cc test vessel (+10cc/-0cc), stopwatch, squeeze bulb, calibrated manometer.

1. Connect Atlas to 500cc test vessel and calibrated manometer as shown in Section 2, Figure 2.1.

2. Turn Atlas on. Press **DATE/TIME** button then press **LEAD SELECT** button to access the Service Mode. Press **SELECT** button and choose Verify manometer.

3. Pressurize the Atlas with squeeze bulb to any pressure above 15 mmHg and maintain that pressure during the test. Start the stop watch.

4. Verify that the valve opens and pressure drops between 155 seconds and 180 seconds.

5. Turn Atlas off.

BP Dump Verification Test

1. Connect the Atlas to a 500 cc vessel as shown in Section 2, Figure 2.1.
2. Turn Atlas on.
3. Press **DATE/TIME** button then press **LEAD SELECT** button to access the Service Mode.
4. Select Verify manometer.
5. Pressurize the Atlas to just over 260 mmHg.
6. Allow reading to stabilize for 15 seconds.
7. Ensure the reading is still over 260 mmHg.
8. Start the stop watch when you press the **SELECT** button. When the **SELECT** button is pressed the Atlas will start a pressure dump.
9. Verify that the pressure drops to below 15 mmHg within 10 seconds.

Hardware Fail Safe Tests

NOTE: *Atlas hardware must detect over pressure on unit pneumatic system between 296.0 mmHg and 330.0 mmHg.*

1. Connect the Atlas for testing as shown in Section 2, Figure 2.1
2. Turn Atlas on.
3. Press **CLOCK/DATE** button then press **LEAD SELECT** button to access Service Mode.
4. Press **SET** button to highlight the Manometer.
5. Pump system up and record at what pressure the Atlas dumps.

ECG/Respiration Test

NOTE: *Simulator should support ECG impedance respiration.*

1. Cycle power on Atlas, connect a 5 lead ECG cable set to the simulator. Configure the simulator for NSR, 100 bpm and set the impedance respiration rate to 20.

2. Press **DATE/TIME** button then press **TREND** button to access Advanced Configuration menu.

3. Press **SELECT** button to highlight ECG lead set and press **SET** button to select 5 wire.

4. Set ECG gain to Automatic, ECG speed to 25mm/s, ECG bandwidth to Monitor, Second trace selection to ECG.

5. Press **TREND** button to return to idle screen.

6. Verify you see: 1. ECG cascading onto second line
   2. Scale bar on top left of CRT
   3. Heart rate displayed as set on simulator
   4. Lead Selected = II
   5. Pulse tone high pitched

7. Press **LEAD SELECT** button and step through each of the lead settings. (I,II,III,aVR,aVL,aVF,V)

8. Verify that you see a different ECG waveforms for each lead selected. Heart Rate will go to dashes and alarms on some leads.

9. Set lead selected to II.

10. Press **DATE/TIME** button then press **TREND** button to access Advanced Configuration menu.

11. Change Second trace selection to Respiration. Press **TREND** button to return to idle screen.

12. Verify that you see:
    1. ECG on top line
    2. Scale bar on left of top line
    3. Heart rate displayed as set on simulator
    4. Lead Selected = II
    5. Pulse tone high pitched
    6. Respiration trace on second line and rate as set on simulator
    7. Respiration rate displayed on CRT as set on simulator.

13. Disconnect ECG simulator.

SpO_2 Test

1. Turn SpO_2 alarms on.

2. Connect SpO_2 cable to simulator.

3. Set simulator pulse rate to 60 beats/minute and verify that pulse rate is 60 ±3 beats/minute or 3%, whichever is greater.

4. Set SpO_2 between 70% and 100% and verify that SpO_2 is accurate ±2 digits.

Temperature Test

1. Without anything connected to the temperature connector on the Atlas, verify that the temperature LED is blank.

2. Using Table 3-2 below, connect the resistors to a 1/4 inch male mono plug and verify temperature readings.

Table 3-2 Resistor and temperature reference.

3. Connect the temperature probe to the Atlas monitor. You should see the display read room ambient temperature. Disconnect the probe and verify you see dashes is the display and that there are no alarms.

CO_2 Functional Test

1. Press **DATE/TIME** button then press **TREND** button to access Advanced Configuration menu

2. Set Second trace selection to CO_2.

3. Press **TREND** button to return to idle screen.

4. Insert watertrap with tubing attached.

5. Verify that you: 1. Hear pump motor start.
   2. See solid line waveform on lower trace.
   3. See dashes in Respiration Rate.
   4. See dashes in mmHg (or % or kPa, as configured).

6. Breathe gently and repeatedly over end of tubing.

7. Verify that you:
   1. See waveform within seconds of breathing.
   2. See respiration rate non zero within one minute.
   3. See CO_2 concentration non zero within one minute.

Battery Functional Test

1. System must have been plugged in for 24 hours to guarantee that the battery is fully charged. But, for now we can do a functional test as follows.

2. Press **DATE/TIME** button then press **LEAD SELECT** button to access Service Mode menu.

3. Press **SELECT** button to highlight Battery test.

4. Verify that the menu reports: 1. Battery Low Time XXX
   2. Battery Dead Time YYY

NOTE: *These are the results from the last battery test. The Battery Low Time is the time in hours and minutes that the battery ran in the last test until the Low Battery alarm started, and the Battery Dead Time is the time from the beginning of the Low Battery Alarm until the system turned itself off when the battery voltage reached the cutoff level.*

NOTE: *2:08 means 128 minutes which is the default setting indicating a battery test has never been made before.*

5. Write down the Battery Low Time and Battery Dead Time.

6. Unplug AC cord to start battery test.

7. The timers will begin the moment you unplug the AC cord. Leave the system on until it powers down by itself automatically. Plug Atlas into AC and turn the Atlas on, enter the Service Mode menu, select Battery Test again, and write down the new values. Compare these to the previous values, and to the minimum specification:
   1. Battery Low Time = 1 Hour
   2. Battery Dead Time = 10 Minute minimums

8. Replace the battery if performance falls below specification.

Printer Functional Test

NOTE: Configuration settings for printing are different for text pages than for waveforms.

1. Connect ECG simulator to generate a sample waveform.

2. Press **PRINT** button and look at waveform printout. Look for darkness, thickness of lines, legibility of text, blurring, “blooming” of text.

3. If waveform or printed text needs to be darker or lighter, go to Section 2, page 10 for printer calibration.

Print on Alarm Test

1. Turn the Atlas on.

2. Press the **DATE/TIME** button then press the **TREND** button to access Advanced Configuration menu. Press the **SELECT** button and scroll down to Print on Alarm. Press the **SET** button and set Print on alarm to No.

3. Connect an ECG simulator to the Atlas. Set the ECG rate on the simulator to 60 bpm, normal sinus rhythm.

4. Press left **SELECT** button and the HI heart rate alarm parameter will flash. Set the high heart rate alarm to 110 bpm on the Atlas and press the **SELECT** button again and the low heart parameter will flash. Press **SELECT** button one more time to return to the default screen.

5. Set the ECG simulator to heart rate to 120 bpm.

6. Verify that you hear the audio alarm and that the printer is not printing.

7. Set the ECG simulator to 60 bpm and make sure that the alarm condition has cleared.

8. Press the **DATE/TIME** button then press the **TREND** button to access Advanced Configuration menu. Press the **SELECT** button and scroll down to Print on Alarm. Press the **SET** button and set Print on alarm to Yes.

9. Set the ECG simulator to 50 bpm.

10. Verify that the printer printed a 15 second strip.

Software/Firmware

1. Review versions written down earlier and compare to latest available. Make sure that all components are compatible with each other. See section 2, page 26, Table 2-3.

ECG Alarms Test

1. Turn the Atlas on. Verify that you hear the power on tone.

2. Press **DATE/TIME** button then press **TREND** button to access Advanced Configuration menu. Press **SELECT** button and scroll down to Second Trace. Press **SET** button and set the second trace to ECG.

3. Connect ECG simulator to the Atlas. Set the ECG rate on simulator to 60 bpm, normal sinus rhythm.

4. Verify you hear the heart rate beep at a constant high pitch.

5. Press **SpO_2 - +** button "-" 8 times. Should get quieter and finally silent.

6. Press **DATE/TIME** button then press **PRINT** button to save settings.

7. Turn system off and back on.

8. Verify pulse tone is silent even though heart rate is shown.

9. Press **SpO_2** volume button **"+"** 8 times. Should get audible tone and then louder.

10. Disconnect ECG cable.

11. Verify you hear audio alarm and see error message "ECG Lead fault" and that you see the three LED bars flash where the heart rate was on the CRT.

12. Press **HR ALARMS Off** button.

13. Verify that the audio alarm stops and that the visual alarm on the CRT remains.

14. Press **HR ALARMS OFF** button. Connect ECG simulator to the Atlas and set simulator to normal sinus, 60 bpm.

15. Press left **SELECT** button and the HI heart rate alarm parameter will flash. Set the high heart rate alarm to 55 bpm on the Atlas and press the **SELECT** button again and the low heart parameter will flash. Press **SELECT** button one more time to return to the default screen.

16. Verify that you hear the audio alarm and that you see the numeric value flashing in the upper right portion of the monitor.

17. Return the high alarm limit to 120 bpm and press **SELECT** button. Verify the audio alarm should is silent and the numeric visual alarm is flashing.

18. Press **SELECT** button twice. Verify the numeric low alarm parameter is flashing.

19. Set the LOW alarm for 65 bpm by pressing the up **SET** button. Press **SELECT** button.

20. Verify that you hear the audio alarm and that you see the numeric value is flashing in the upper right portion of the monitor.

21. Turn the Atlas off.

Respiration Alarms Test

1. Turn Atlas on.

2. Press **DATE/TIME** button then press **TREND** button to access Advanced Configuration menu. Press **SELECT** button to scroll down to Second Trace. Press **SET** button and set second trace to respiration. Press **TREND** button to return to default screen.

3. Set respiration on simulator to 20 respirations/minute and connect to the Atlas.

4. Press left **SELECT** button three times and set the hi respiration alarm to less than 20. Wait 10 seconds and the CRT will return to the default screen.

5. Verify that you hear the audio alarm and that the respiration numeric value on the CRT is flashing.

6. Press **CO_2/RESP ALARMS** off button.

7. Verify that the audio alarms are silent, the visual numeric alarm is flashing and that the red LED in the **CO_2/RESP ALARM off** button is lit.

9. Press left **SELECT** button three times to access hi respiration alarms and set hi alarm to 30.

10. Wait ten seconds and the CRT will return to the default screen.

11. Press **CO_2/RESP ALARM off** BUTTON then press left **SELECT** button four times to access low respiration alarms and set low respiration alarms to 25.

12. Wait 10 seconds and CRT will return to the default screen.

13. Verify that you hear the audio alarm and that the respiration numeric value on the CRT is flashing.

14. Press **CO_2/RESP ALARMS off** button.

15. Verify that the audio alarms are silent, the visual numeric alarm is flashing and that the red LED in the **CO_2/RESP ALARM off** button is lit.

16. Turn Atlas off.

SpO_2 Alarm Test

1. Turn Atlas on.
2. Attach SpO_2 to a simulator and set for 95% SpO_2.
3. Verify that you hear a pulse rate beep and that it is a different pitched tone than the ECG pulse beep.
4. Change SpO_2% setting on the simulator. Verify that tone changes pitch up or down tracking simulator setting.
5. Press lower far right **SELECT** button until SpO_2 LO is flashing, press right **SET** button UP to change SpO_2 LO setting to 99.
6. Wait until the SpO_2 LO LED stops flashing.
7. Verify that you hear the SpO_2 LO limit alarm.
8. Press **Alarm Volume** button **"-"** eight times. Verify tones gets quieter but not silent.
9. Press **Alarm Volume** button **"+"** eight times. Verify the tone gets louder.
10. Disconnect SpO_2 cable from simulator and verify that the visual alarm "SpO_2 cable not detected" is displayed on the bottom left side of CRT. Verify that you hear the audio alarm.
11. Press **SpO_2 ALARMS Off** button.
12. Verify that the audio alarm sound is silent, that you do not see the visual alarm message "SpO_2 cable not detected" on the CRT and that the LED in the SpO_2 ALARMS OFF button is on.
13. Turn Atlas off.
14. Disconnect SpO_2 cable from Atlas.

Silence Alarm Test

1. Turn Atlas on.

2. Press **DATE/TIME** button then press **TREND** button to access Advanced Configuration menu. Press **SELECT** button until Silence Duration is highlighted. Press **SET** button until 90 seconds is highlighted. Press **TREND** button to go to default screen.

3. Connect ECG simulator to the Atlas. Set the ECG rate on simulator to 60 bpm, normal sinus wave.

4. Press left **SELECT** button once and set the HI alarm to 55 bpm.

5. Wait until you hear the audio alarm.

6. Press **SILENCE** button and start stopwatch. Verify that the alarm returns at 90 seconds.

7. Turn Atlas off.

CO_2/RESP Test

1. Turn Atlas on.

2. Press **DATE/TIME** button then press **TREND** button to access the Advanced Configuration menu.

3. Set Second trace selection to CO_2.

4. Press **TREND** button to return to idle.

5. Insert CO_2 watertrap with hose.

6. Breath into hose until a waveform is displayed.

7. Remove CO_2 watertrap .

8. Verify you hear the audio alarm and that you see in the visual alarm " CO2 watertrap not detected" in the bottom left portion of CRT.

9. Press the **" CO_2/RESP ALARMS off "** button. Verify that the audio alarm goes silent, the visual alarm goes out and the red LED in the **CO_2/RESP ALARMS off** button is lit.

10. Turn Atlas off.

Blood Pressure Alarm Test

1. Turn Atlas on.

2. With no hose connected to the BP port, press **BP Start/Cancel** button.

3. Place finger over BP port. This will block the flow causing the Atlas to detect an over pressure.

4. Verify that you hear the audio alarm, that the visual alarm " Check Blood Pressure Cuff " appears in the lower left portion of the CRT and that the SYSTOLIC and DIASTOLIC LED displays are flashing.

5. Press the **BP ALARMS OFF** button.

6. Verify the audio alarm is silent, the visual alarms have turned off and that the red LED in the **BP ALARMS OFF** button is lit.

7. Press the **BP ALARMS OFF** button then press the **BP START/CANCEL** button twice.

8. Press **BP START/CANCEL** button and let Atlas run without anything attached to the BP port.

9. Verify at 60 seconds that you hear the audio alarm and that the visual alarm " Check Blood Pressure Cuff " appears in the lower left portion of the CRT and that the SYSOLIC and DIASTOLIC LED displays are flashing.

10. Press the **BP ALARMS OFF** button.

11. Verify the audio alarm is silent, the visual alarms are still off and that the red LED in the **BP ALARMS OFF** button is lit.

12. Press the **BP ALARMS OFF** button then press the **BP START/CANCEL** button twice.

13. Connect a BP simulator to the Atlas BP port. Set the simulator for a normal reading (140/80, 100 bpm, normal sinus rythym).

14. Press the right **SELECT** button twice and the current SYSTOLIC HI alarm value will be flashing.

15. Press the **SET** button to set SYSTOLIC HI alarm to 130.

16. Press **BP START/CANCEL** button.

17. Verify that you hear the audio alarm and that the numeric value in the SYSTOLIC LED display is flashing.

18. Press the **BP ALARMS OFF** button.

19. Verify the audio alarm is silent, the numeric value in the SYSTOLIC LED display is still flashing and that the red LED in the **BP ALARMS OFF** button is lit.

20. Reset the SYSTOLIC HI alarm to 200 (factory default). Press **BP ALARMS OFF** button.

21. Press the right **SELECT** button three times and the numeric value in the SYSTOLIC LO alarm LED display will be flashing.

22. Press the **SET** button to set the SYSTOLIC BP LO alarm to 160.

23. Press **BP START/CANCEL** button.

24. Verify that you hear the audio alarm and that the numeric value in the SYSTOLIC LED display is flashing.

25. Press the **BP ALARMS OFF** button.

26. Verify the audio alarm is silent, the numeric value in the SYSTOLIC LED display is still flashing and that the red LED in the **BP ALARMS OFF** button is lit.

27. Reset SYSTOLIC LO alarm to 70 (Factory default). Press **BP ALARMS OFF** button.

28. Press right **SELECT** button four times and the numeric value in DIASTOLIC HI alarm LED display will be flashing.

29. Press the **SET** button and set DIASTOLIC HI alarm to 70.

30. Press **BP START/CANCEL** button.

31. Verify that you hear the audio alarm and that the numeric value in the DIASTOLIC HI LED display is flashing.

32. Press the **BP ALARMS OFF** button.

33. Verify the audio alarm is silent, the numeric value in the DIASTOLIC LED display is still flashing and that the red LED in the **BP ALARMS OFF** button is lit.

34. Reset DIASTOLIC hi alarm to 155 (Factory Default).

35. Press right **SET** button five times and the numeric value in the DIASTOLIC LO alarm LED display will be flashing.

36. Press **SET** button and set DIASTOLIC LO alarm to 90. Press **BP ALARMS OFF** button.

37. Press **BP START/CANCEL** button.

38. Verify that you hear the audio alarm and that the numeric value in DIASTOLIC LED display is flashing.

39. Press the **BP ALARMS OFF** button.

40. Verify the audio alarm is silent, the numeric value in the DIASTOLIC display is still flashing and that the red LED in the **BP ALARMS BUTTON** is lit.

41. Reset DIASTOLIC LO alarm to 50 (Factory Default).

42. Turn Atlas off.

Table 3-3. Atlas trouble shooting.

Failures		Possible Solutions
Power on:		
Unit does not power up, no AC on LED, no Power on LED.	1	Check AC power cord.
	2	Verify connection from power supply to main board.
	3	Verify +12V output from power supply.
	4	Replace Power Supply.
	5	Check Cable from main board to display board.
	6	Replace Display board.
Unit does not power up - AC and Power on LED on.	1	Check that the CPU board is fully seated.
	2	Replace CPU board.
	3	Check for conformal coating in J4 header - replace board if coating is found.
	4	Replace Main board.
	5	Replace Display board.
Unit powers up intermittently or Power button sticks or cannot duplicate power on problem But unit passes burn in.	1	Remove flashing on Bezel at power button.
	2	Check for severely tipped power button LED on display board.
Unit powers up - but no image on CRT.	1	Check for conformal coating in J4 header - replace board if coating is found.
	2	Replace CPU board.
	3	Check for correct installation of connection from main board to deflection board. If installed with pin 1 in the pin 2 socket deflection board will be damaged. If installed with pin 1 out of socket deflection board will be OK.
	4	Replace CPU assembly.

Table 3-4. Atlas trouble shooting.

Failures		Possible Solutions
Display:		
Segment out, LED out, Buttons do not work.	1	Replace Display board.
All or most segments stay on at power up.	1	Replace CPU board.
	2	Check cable from Display board to Main board.
	3	Replace Power Supply.
CRT:		
CRT image rotated or poor alignment.	1	Rotate yoke and/or adjust magnets.
Only see a dot in the center of the screen.	1	Check cable from yoke to CRT board.
Only see a horizontal line in the center of the screen.	1	Check cable from yoke to CRT board.
	2	Replace Deflection board.
No image - CRT to Main board connection OK.	1	Check flex-cable from Deflection board to tube.
	2	Check high voltage anode connection.
	3	Replace Deflection board.
	4	Replace tube.
	5	Replace CPU board.
No image - Glow at bottom of screen.	1	Check for conformal coating in J4 header - replace board if coating is found.
	2	Replace CPU board.
Dark vertical scan lines in image.	1	Replace CPU board.

Table 3-5. Atlas trouble shooting.

Failures		Possible Solutions
Printer:		
Motor does not run.	1	Check that the unit is configured for printer. (CRT image will freeze for 10 seconds if configured for no printer.)
	2	Check cable from printer PCB to motor.
	3	Check cable from printer PCB to Main board.
	4	Check motor gear alignment to first plastic gear.
	5	Check for paper jam.
	6	Replace printer PCB.
	7	Replace CPU.
Motor runs or chatters - paper does not advance.	1	Check for missing dowel pin in roller.
	2	Check for missing bearings/gears.
	3	Replace printer PCB.
	4	Replace CPU.
Light print or no print.	1	Check that paper is properly installed (thermal side visible).
	2	Check cable from printer PCB to print head.
	3	Check printer-strobe-width in NVRAM (could indicate error in printer thermistor circuit). If low, check printer PCB, Main board, and CPU board.
	4	Check mechanical assembly for proper force of printhead on paper.
Prints gibberish.	1	Reseat CPU board.
	2	Replace CPU board.
	3	Replace Printer to Main board cable.
	4	Replace printer PCB.

Table 3-6. Atlas trouble shooting.

Failures		Possible Solutions
Safety:		
Earth resistance over limit.	1	Check ground wire from motor to power supply can.
	2	Tighten screws that attach ground tabs to power supply can.
	3	Tighten screws holding power supply PCB to can.
	4	Tighten quick connects on AC harness to power supply.
	5	Replace power supply PCB.
Blood Pressure:		
Leak test - Fails Leak Specification	1	Run individual test. If unit passes repeat all tests.
	2	Check seals @ tubing in BP assembly.
	3	Check for lifted pins on the CPU connector JP8.
	4	Replace Check valve.
Leak test - 'Can't pump beyond xxx.xx'.	1	Verify unit can pump beyond 300 mmHg then: Retest.
	2	If pump will not reach 300 mmHg, then: A. Check for correct direction on check valve. B. Check for possible leaks. C. Check for pinched tubing. D. Replace pump.
Manometer Accuracy - 'Can't pump beyond xxx.xx'.	1	Verify unit can pump beyond 300 mmHg then: Retest.
	2	If pump will not reach 300 mmHg, then: A. Check for correct direction on check valve. B. Check for possible leaks. C. Check for pinched tubing. D. Replace pump.
	3	Check for lifted pins on the CPU connector JP8.

Table 3-7. Atlas trouble shooting.

Failures		Possible Solutions
Manometer Accuracy - Fails Accuracy Specification.	1	Replace Main board. Faulty transducer or amp.
Deflation Profile.	1	Replace dump valve.
	2	Replace Main board. Valve drive circuitry fault.
Overpressure Limit - 'Can't pump beyond xxx.xx'.	1	Verify unit can pump beyond 300 mmHg then: Retest.
	2	If pump will not reach 300 mmHg then: A. Check for correct direction on check valve. B. Check for possible leaks. C. Check for pinched tubing. D. Replace pump.
Overpressure Limit - Fails Accuracy Specification.	1	Replace Main board. Fault with pressure transducer, amplifier, or comparator.
	2	Replace CPU board.
Dwell time.	1	Replace Main board. - Fault with 15 mmHg detect circuit.
	2	Replace CPU board. - Fault with timer.
Dwell Pressure.	1	Replace Main board- If fault with 15 mmHg detect circuit.
	2	Replace CPU board.

Table 3-8. Atlas failure trouble shooting.

Failures		Possible Solutions
SpO2:		
No Signal - SpO2 fault message on CRT.	1	Plug in finger cuff, connect to your finger & check for function. If function is normal retest. If not continue to step 2.
	2	Check cables - SpO2 board to Main board, SpO2 board to Bezel.
	3	Replace Main board.
	4	Replace SpO2 board.
	5	Replace CPU board.
SpO2 signal accuracy.	1	If Nellcor, check ribbon cable and harness. Replace as needed.
	2	Replace SpO2 board.
ETCO2:		
Specification limits fail - Flow rate or Percentage.	1	Perform calibration. If that does not fix then go to step 2.
	2	Replace Pryon board.
ETCO2 failure.	1	Check for broken switch in trap receptacle.
	2	Verify board ID in service module.
	3	Perform functional test of ETCO2. Verify pump comes on when switch in water trap receptacle is activated. If switch is intermittent replace the receptacle.
	4	Replace Pryon board.
	5	Replace CPU board.
Temperature:		
	1	Check connection - main board to temperature jack.
	2	Check pins in Temperature harness for correct seating.
	3	Replace Main board.

About Section 4

This section is a guide for disassembly and reassembly of the Atlas Monitor. Always refer to current revision schematics, diagrams and final safety test procedures before attempting to service this device.

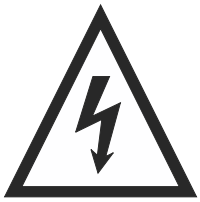
Do not attempt to service this instrument unless you have received Service Training from Welch Allyn or an authorized Training Agent, and are equipped with approved processes and test equipment. For more information about training call the Welch Allyn Customer Service phone number listed in Section 1 of this manual.

General:
The outside housing is removable in order to provide full access to all internal printed circuit boards and other components. Most of these are held in position with the surrounding "E-Pac" foam. E-Pac foam provides shock absorption, ventilation channels, and spaces for the components and boards. Pneumatic tubing and cables must be placed correctly in E-Pac to avoid problems with pinched tubing.

Problems During Service:
A Technical Support phone number is listed in Section 1 of this manual to answer questions you may have during the servicing of the Atlas Monitor.

Printer:
Print-head, printer motor, and printer roller can be replaced as necessary.

Printed Circuit Boards:
There are no component level repairs for the Printed Circuit Boards(PCB). These are replaced if found to be defective. During the warranty period, boards that are found to be defective should be returned to Welch Allyn.



CAUTION

Electrical Shock Hazard

EXERCISE EXTREME CAUTION WHEN SERVICING THE ATLAS MONITOR! THE CRT ASSEMBLY AND CRT DEFLECTION BOARD OPERATE ON APPROXIMATELY 8,000 VOLTS.

CRT:
The CRT and CRT Deflection Board are aligned at the factory and as such are replaced as a matched set if one or the other should fail in service.

ESD: Circuit Boards are sensitive to static electricity. Use wrist straps, ESD mats and ESD storage bags.

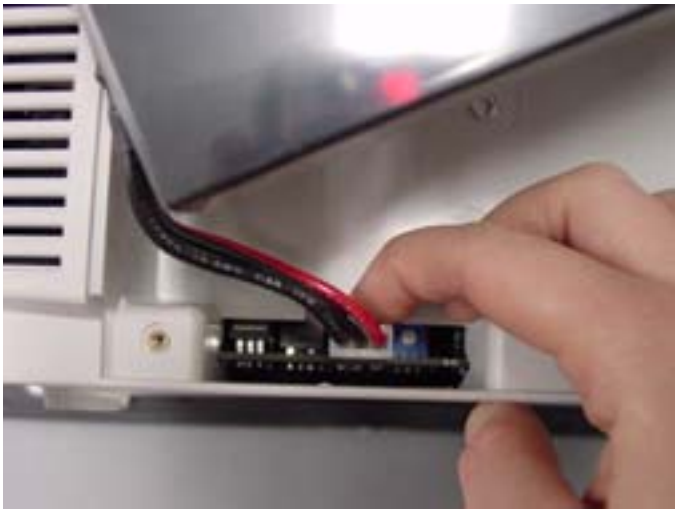
Model 220 (623NP)

1. Battery Door Removal

Remove the two screws holding the battery door. Remove the battery door.

2. Battery Removal

Remove the battery connector from the main PCB. Remove battery.



3. Rear Housing Removal

3.1 Remove the four Torx head machine screws. Use a #10 Torx driver.

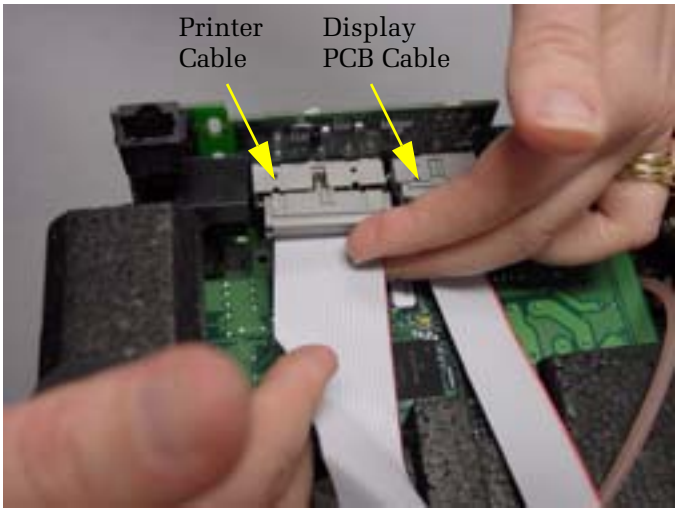
3.2 Pull the rear housing away from the front panel. Take special care not to damage any cables.

3.3 Flip the housing forward. Take special care not to damage any cables.

NOTE: *Observe how hose fits in E-Pac Foam. The hose fits over wiring keeping wiring secure.*

4. Printer cable and Display Cable Removal

Remove both Printer and Display PCB cables from the Main PCB.

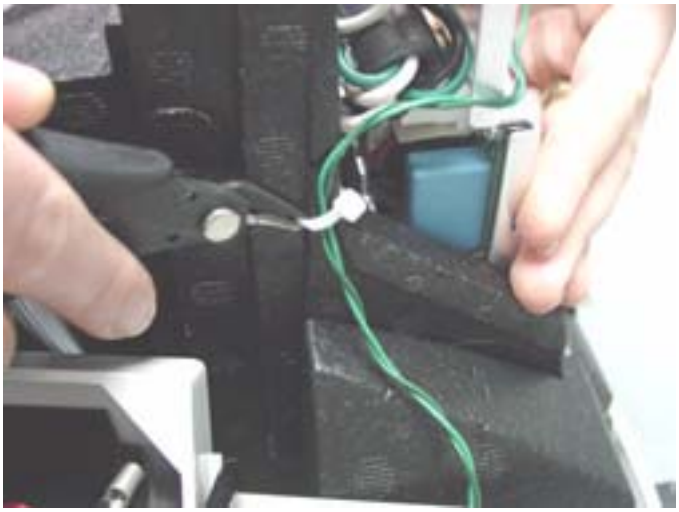


5. Power Supply Ground Wire Removal

Remove the two ground connectors from power supply chassis.

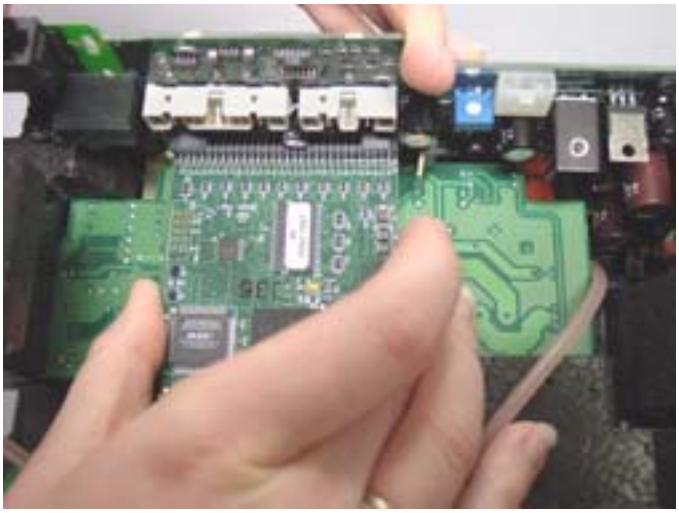
6. Tie Wrap Removal

Cut the tie wrap that secures the ground wires to the E-pac foam.



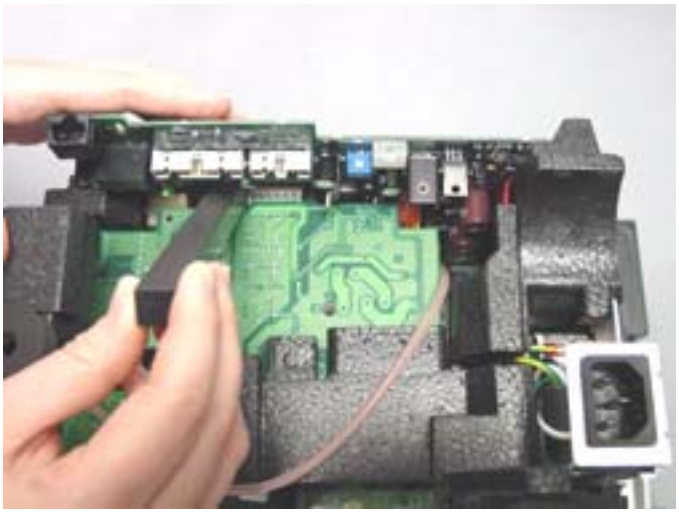
7. CPU Removal

Remove the CPU from the Main PCB.



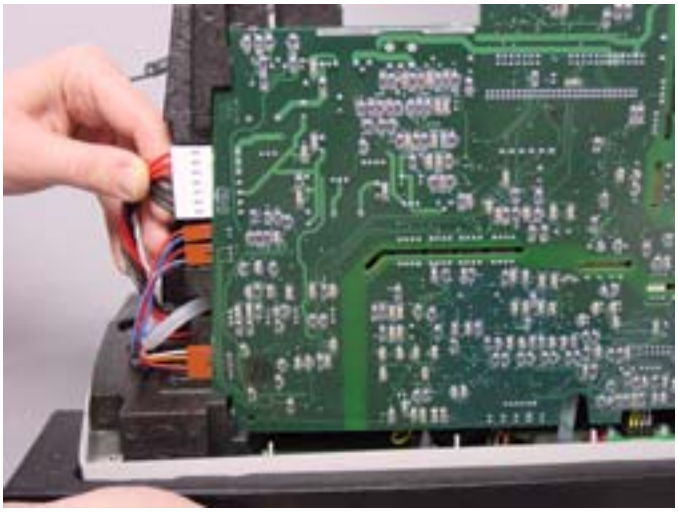
8. Main PCB Removal

Use a tool T-16654 to pry the main Board away from the Deflection Board. Pull the E-pac tab to the right as you pry. Support the Main PCB while titling it away.



9. Main PCB Side Connector Removal.

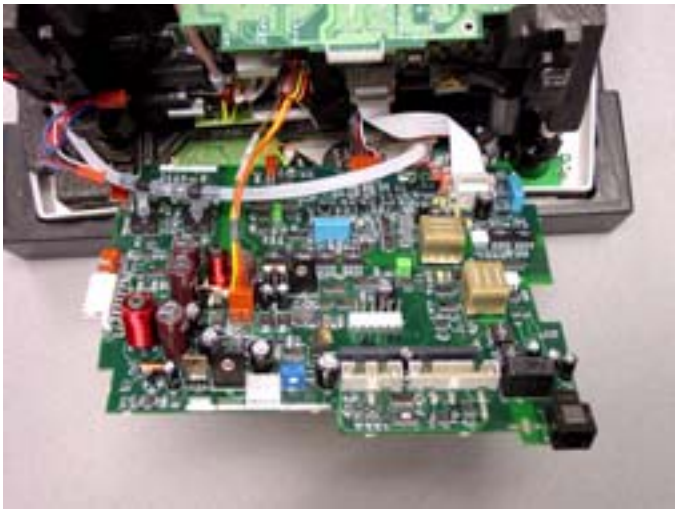
Remove the four connectors(power supply, fan, speakers, BP pump) from the side of the main PCB.



10. Main PCB Hose and Wire Removal.

Disconnect hoses and connectors. BP hose, ecg cable, temp cable (modles 622 and 623 only, SpO_2 cable, CO_2 cable (model 623 only)and ground wire (Nelcor SpO_2 only) from main PCB.

***NOTE**: Notice how hoses and connectors fit on Main PCB.*



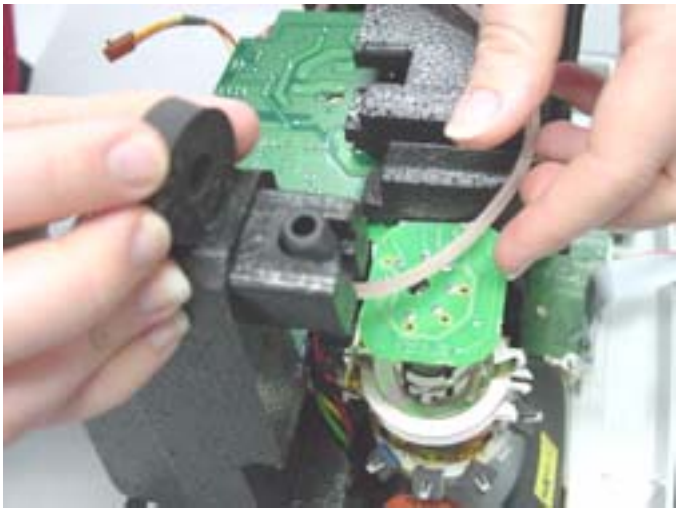
11. Pump Removal.

Remove the pump assembly from the E-Pac foam.

***NOTE:** Notice how pump fits in E-Pac Foam and how wires are routed out of pump.*

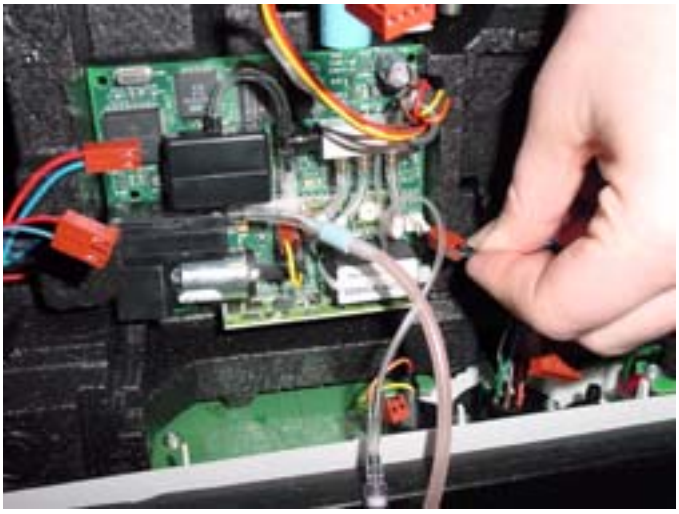
12. CO_2 Exhaust Removal.

Remove the CO_2 exhaust cover and remove the CO_2 connector from the E-Pac foam.



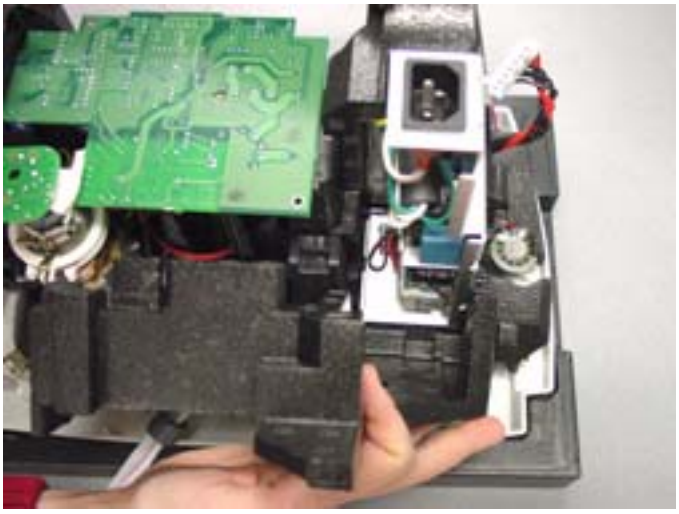
13. Pryon PCB Removal.

Remove connectors from Pryon PCB. Pull Pryon PCB from E-Pac foam.



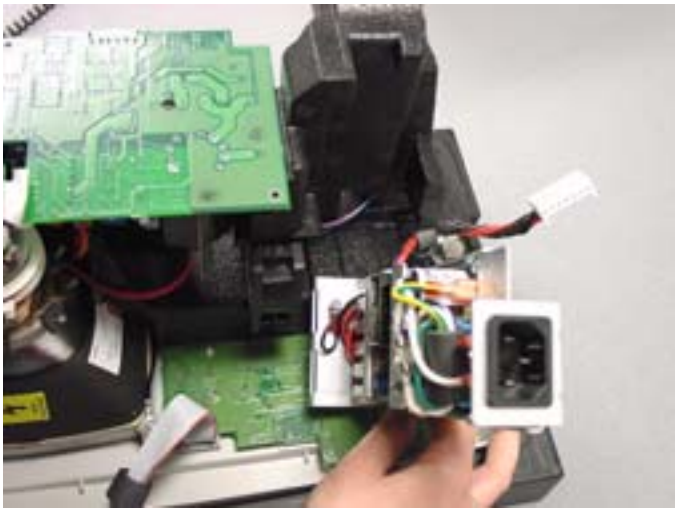
14. E-Pac Foam Removal (Top).

Remove the top E-Pac foam.



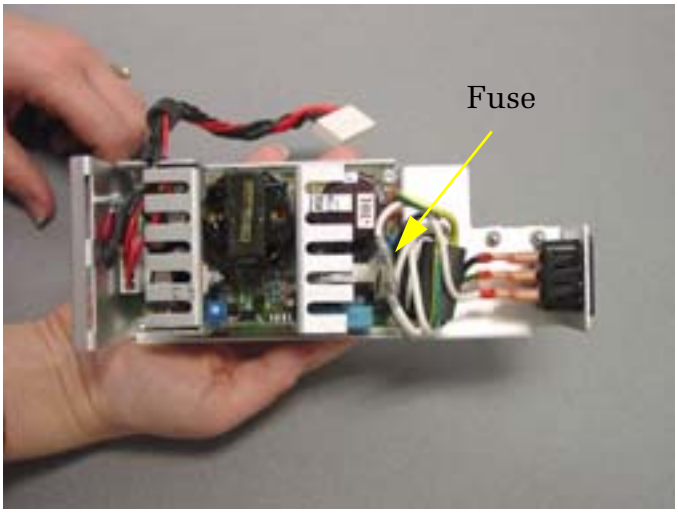
15. Power Supply Removal.

Slide the power supply out from the E-Pac Foam.



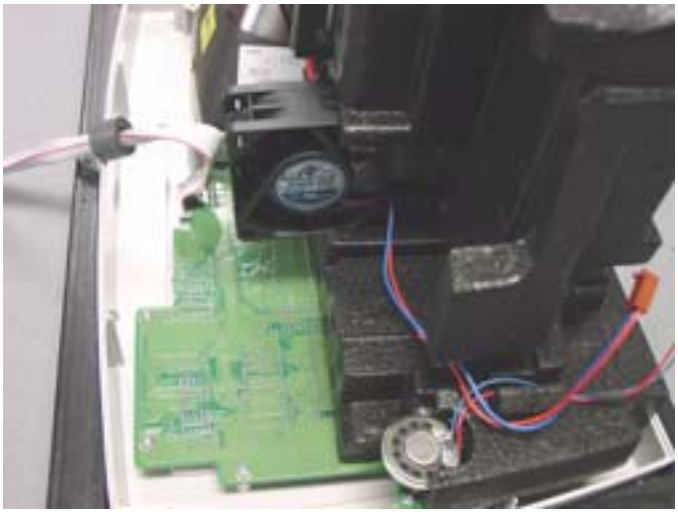
16. Power Supply Fuse Location

NOTE: *Notice power supply and power supply fuse location.*



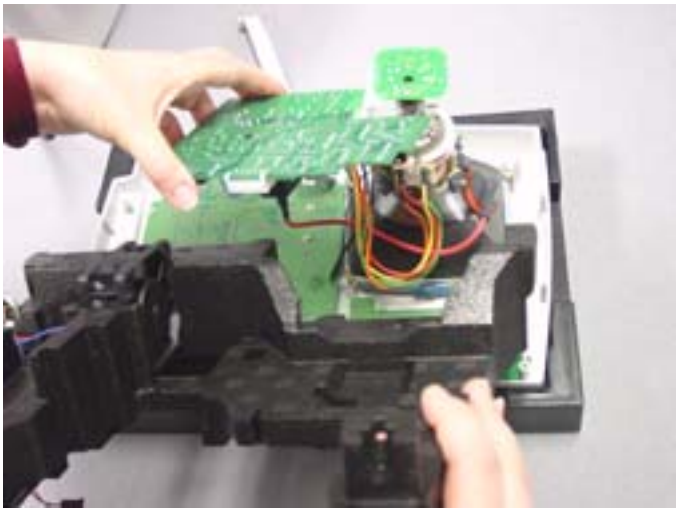
17. Fan Removal

Slide fan out from E-Pac foam.



18. E-Pac Removal (Lower)

Remove lower E-Pac foam from unit.



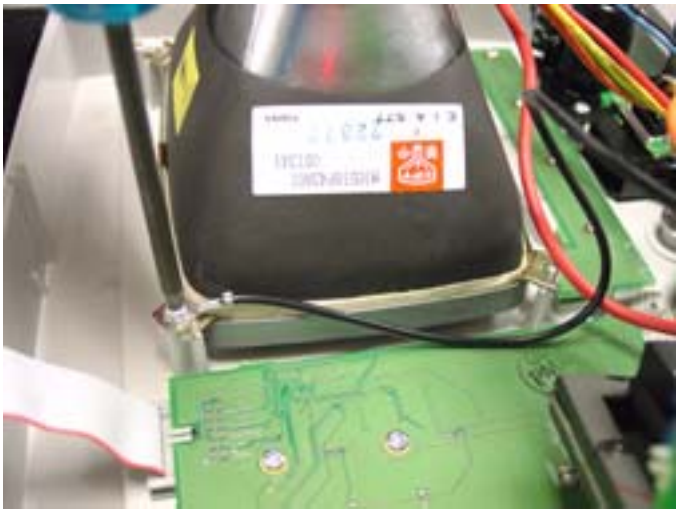
19. Deflection PCB Removal

Carefully remove the small deflection PCB from the CRT.

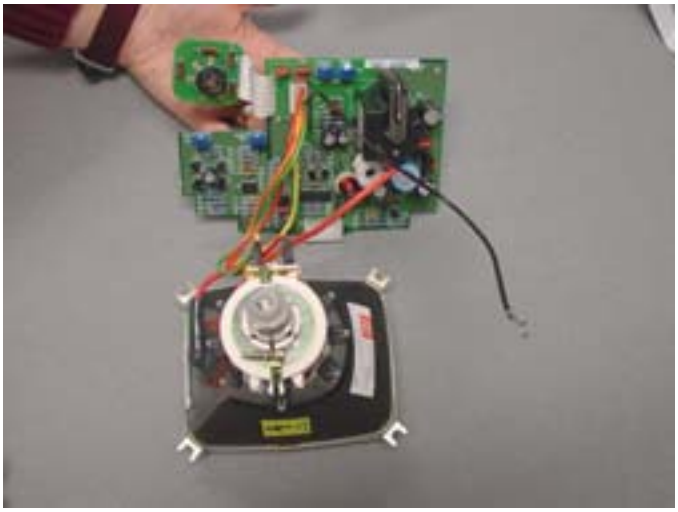
20. CRT Removal

Remove the two machine screws holding CRT to the front panel.

NOTE: *Notice how the ground wire is attached and is located along the side of CRT.*



NOTE: *The CRT and deflection PCB are factory tuned as a unit and are sold only together as a unit.*



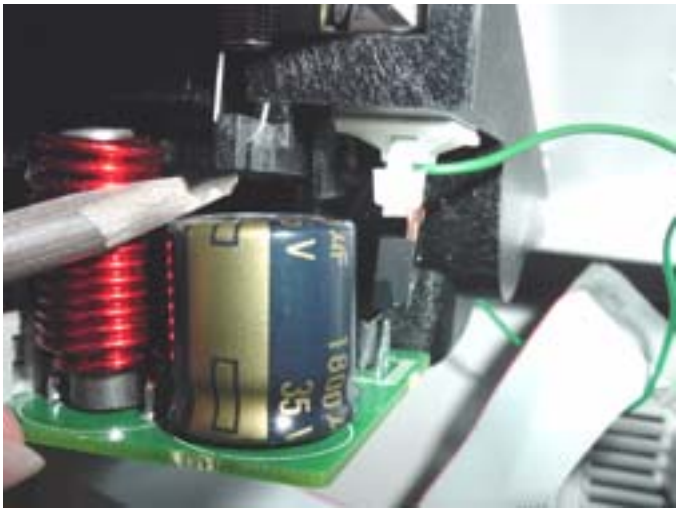
21. Display PCB Removal

Remove all 9 self tapping screws that hold the Display PCB to the Bezel.

NOTE: *Notice the correct orientation of CRT screw and washer.*

22. Printer Door Button Removal

Use a small screwdriver to push the door button tab up and away from the pin that locks it onto the printer frame.



NOTE: *Notice how the printer button is being removed.*

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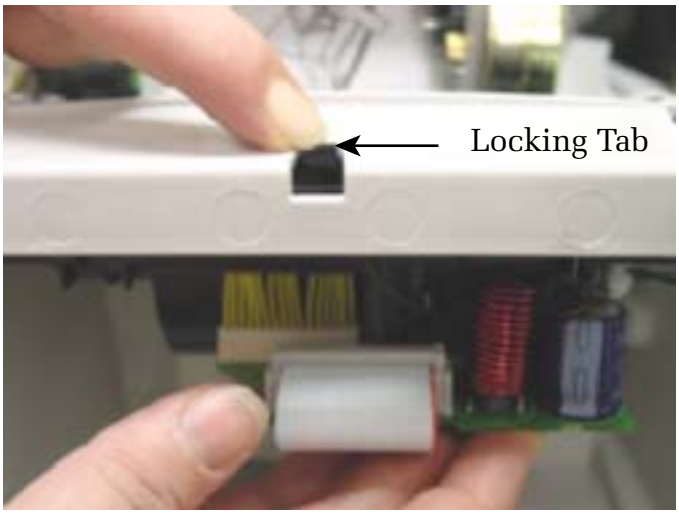
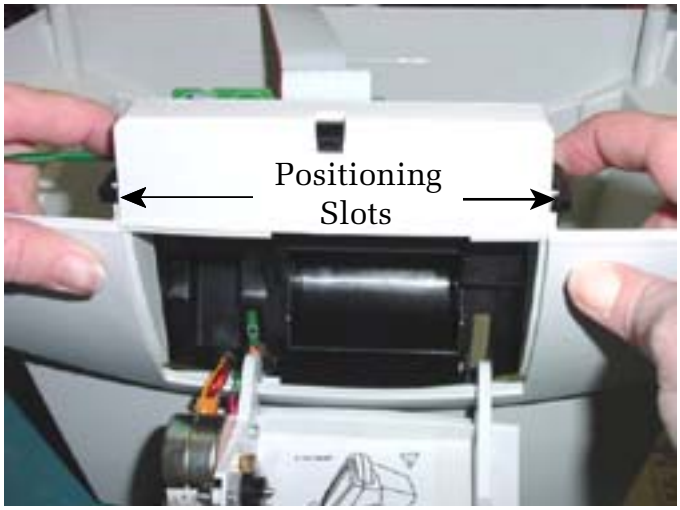
23. Printer Assembly Locking Tab Release.

Pull the locking tab down and towards the front of the rear housing assembly.



24. Printer Positioning Slot Removal

Make sure printer door is open. Begin to pull the positioning slots towards the front of the rear housing and then out from the rear housing.



25. Printer Assembly Removal.

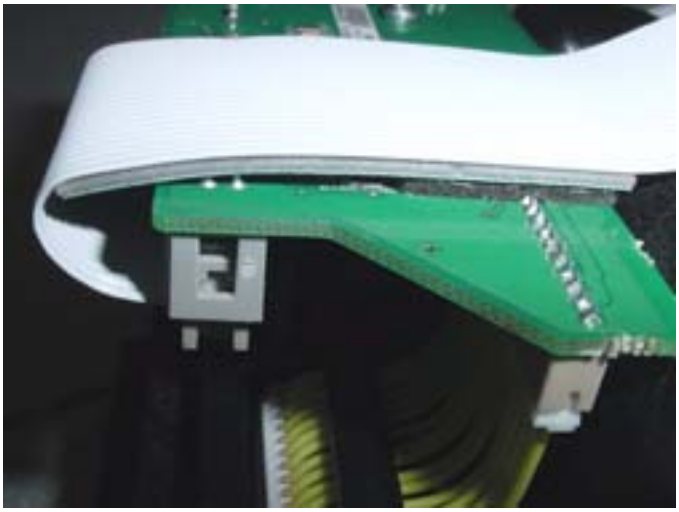
After printer positioning slots have cleared the front rear housing, pull the printer down and out of the rear housing.

26. Printer Lip Assembly.

Observe how the printer assembly fits into the lip of the rear housing.

27. Printer Cable Routing.

Observe how the printer cable lies over the printer PCB.



Power Supply Circuits

Model 621

Atlas Model 621 uses a 50W, medical grade, offline switcher which provides 12VDC from a universal AC input (85VAC to 264VAC – 50/60Hz). The model 621 can only be powered from external AC.

The following supplies are generated on the Atlas Main Board:

+12V DC	CRT, input to isolated power supply, misc. analog circuits.
6V DC	NIBP Pump and Valve, input to 5V and 3V regulators (5.7V nom).
+5V DC	Front panel LED's, misc. logic.
+3.3V DC	CPU board.
Vbackup:	On/Off circuits.

Note: *Additional electrically isolated supplies are generated for patient connected circuits.*

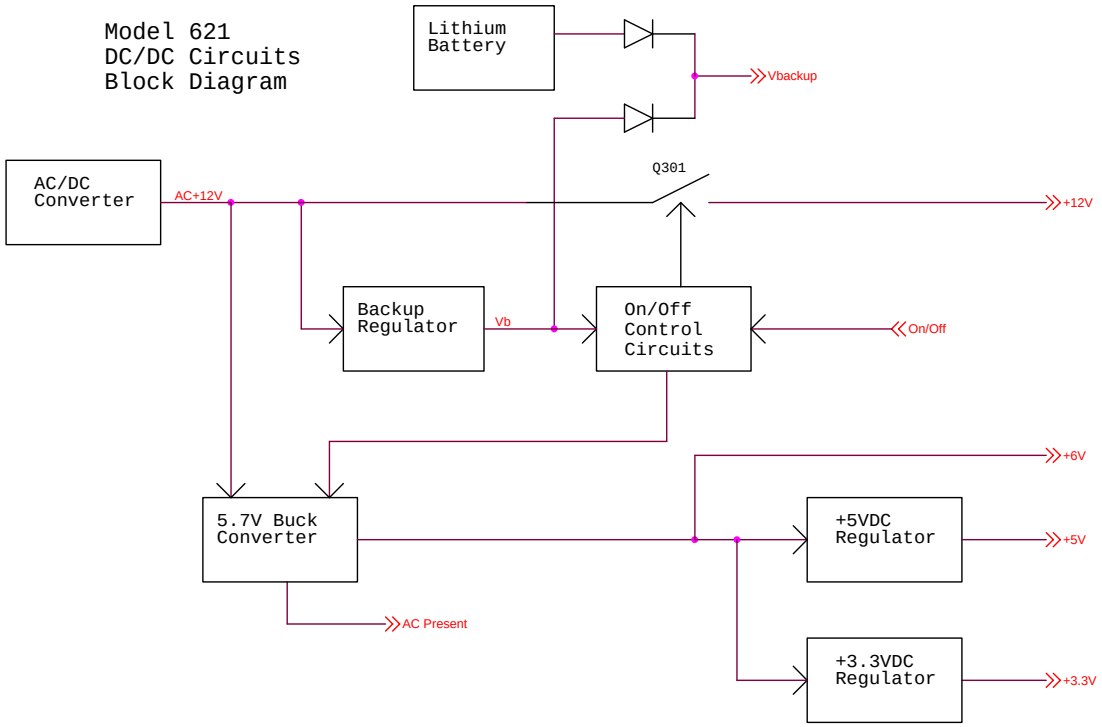


Figure A-1. Model 621 DC/DC circuit block diagram.

On/Off Circuits – Backup Regulator and Micro-Controller

A 3.3V regulator, U304, provides power to the On/Off circuits. This voltage is diode OR'd (D304) with the lithium backup battery to provide power to the real time clock on the CPU board. The On/Off circuitry is controlled by the micro controller U305. This controller performs the following functions:

1. Monitors the status of the front panel ON-OFF key. If the unit is off and the ON-OFF key is pressed, the controller will drive U10-6 high, which will enable power to the remainder of the instrument.

2. At power up, the micro controller will drive the beeper for about 1 second.

3. At power up, the micro controller will reset Shift Register U2. This will cause the following:

a. The front panel LED's are blanked.
b. The NIBP pump drive is placed in the off state.

4. When the unit is ON the micro controller will communicate with the system CPU. When the front panel ON-OFF key is pressed, the CPU will store away current operating conditions, then issues a command to the micro controller to shut instrument power off. U10-6 is driven low which will remove power from the remainder of the instrument.

The instrument is powered on as follows:

U305-6 is driven high, which turns transistor Q302 on (output low)
Q301 (P-channel MOSFET) ON when the gate is pulled low, then +12V active.
Q306 is turned off, allowing the 5.7V buck converter to power on.
As 5.7V becomes active, the 5V and 3.3V supplies also become active.

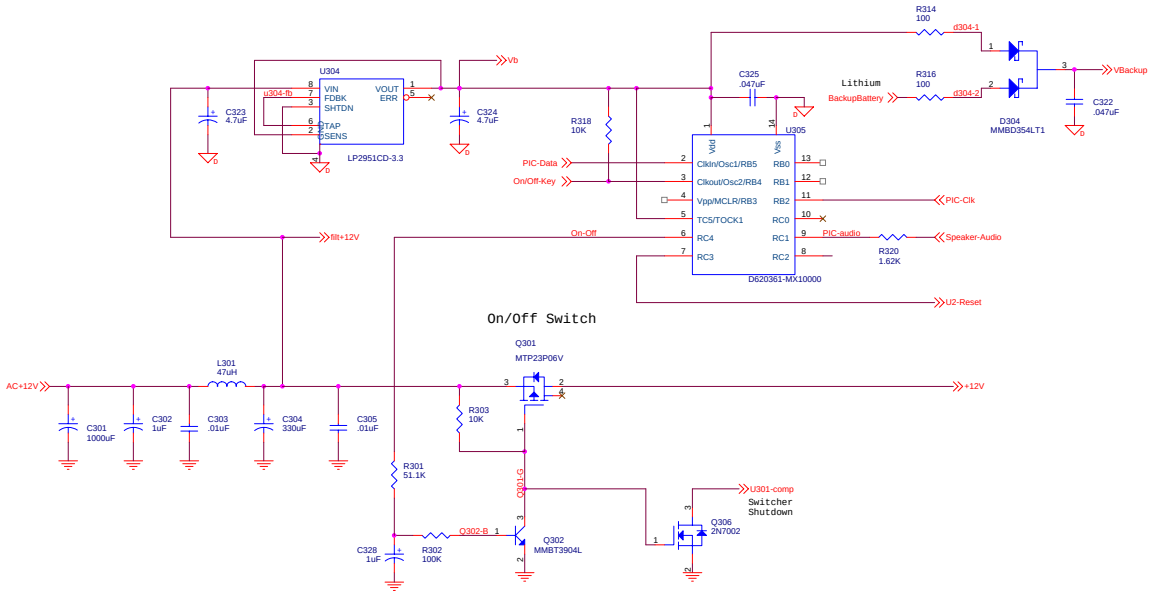


Figure A-2. On/Off Control Circuits.

Buck Converter

A buck converter is used to generate 6V from the 12VDC output of the offline switcher. The UC3843A (U301), normally a current mode controller, is configured for voltage mode feedback. The UC3843A has an under-voltage lockout for Vcc<8.5V. The controller operates such that with Vcc less than 8.5V, the reference out is 0V, and will be at 5V with Vcc>8.5V.

Then, the reference out (pin 14) can be used as an AC-ON detection signal.
The switching transistor for the buck converter is a P-Channel MOSFET (Q305). The output drive of the controller is the wrong polarity for driving a P-Channel MOSFET in a step down mode. Therefore, transistor Q303 is added to invert the PWM out signal. Fast turn-on of Q305 is provided when Q303 is low, fast turn-off is though Q304 (configured as an emitter follower). The PWM controller includes an internal 2.5V reference. Voltage regulation is controlled with sampling resistor R304 and R305 such that Vout = 2.5V*(1+R304/R305) = 5.68V. At power down pin U301-1 (comp pin) is pulled low. This will cause U301-10 to go low, which turns Q305 off and disables power to +6V.

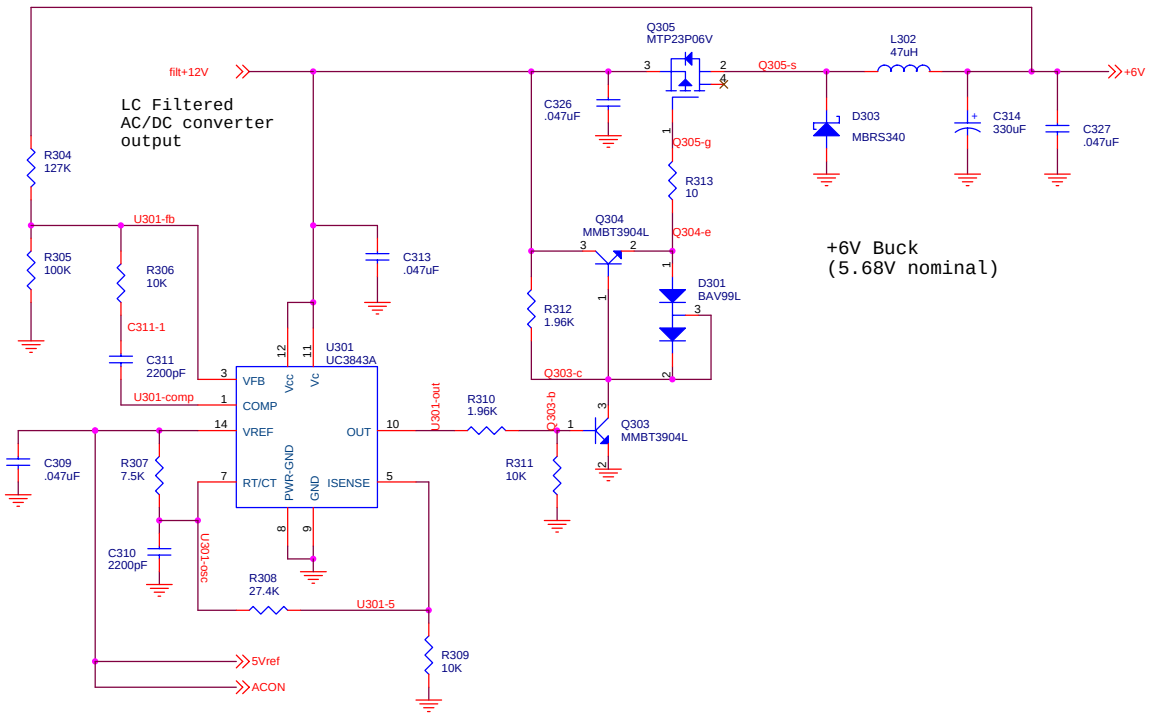


Figure A-3. Model 621 Buck converter.

Linear Regulators – 5VDC and 3.3VDC

Three terminal linear regulators, U302 and U303, are used to develop regulated 5V and 3V. The regulators are powered by the output of the 6V PWM converter. These regulators do not include a power down mode, but the voltage will collapse as the input voltage shuts down.

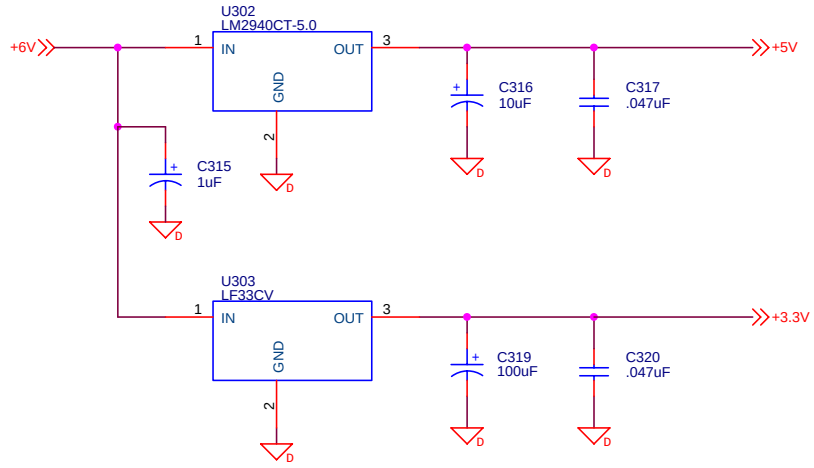


Figure A-4. Model 621 linear regulation.

Model 622 and Model 623

Atlas Model 622 and 623 can be powered either from AC or battery. A 50W, medical grade, offline switcher provides 12VDC from a universal AC input (85VAC to 264VAC – 50/60Hz). The battery is a rechargeable 6-Volt, 6.5 Amp-Hour, Sealed Lead Acid Battery, and will provide about 1.5 hours on a fully charged battery (Battery Life depends on usage, especially printer usage, NIBP cycles, and CO2 operation).

The unit will operate from AC when the unit is plugged in, and switches to battery operation when AC is removed. The battery is automatically charged whenever AC is connected.

The following supplies are generated on the Atlas Main Board:

+12V DC	CRT, CO2, input to isolated power supply, misc. analog circuits.
+5V DC	Front panel LED's, misc. logic.
+3.3V DC	CPU board.
3.3V Backup:	Real time clock and On/Off circuits.
Battery Charger:	Charges SLA battery.

Note: *Additional electrically isolated supplies are generated for patient connected circuits.*

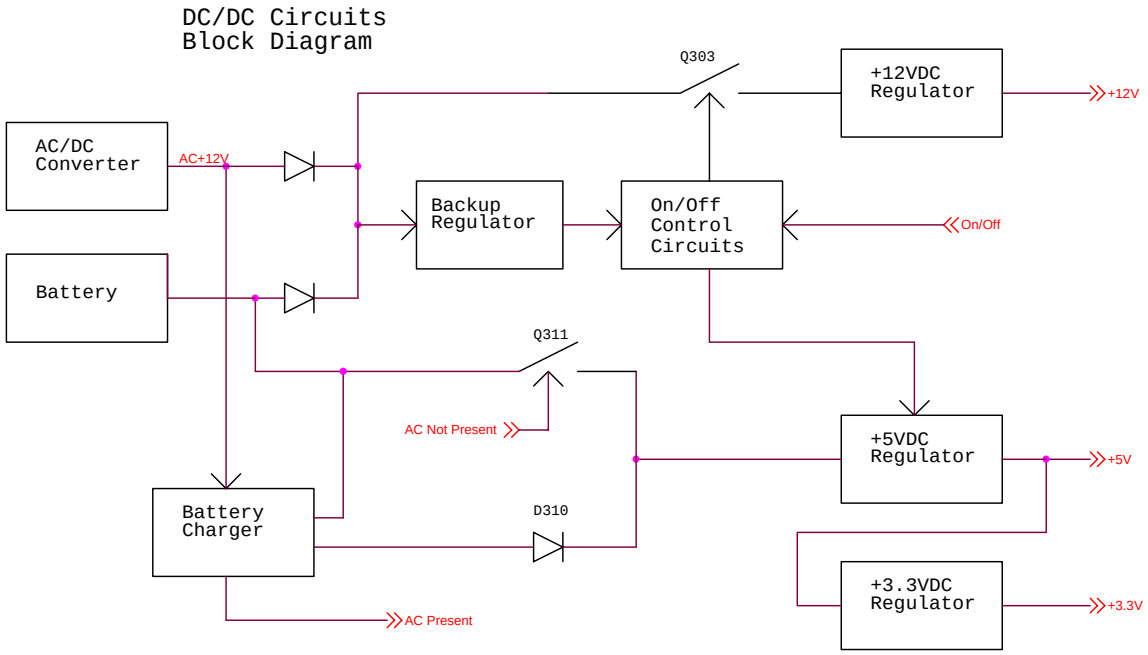


Figure A-5. DC/DC circuit diagram.

On/Off Circuits

Backup Regulator and Micro-Controller

A 3.3V low current regulator, U307, provides power to the On/Off circuits and to the real time clock on the CPU board. The On/Off circuitry is controlled by the micro controller U10.

This controller performs the following functions:

1. Monitors the status of the front panel ON-OFF key. If the unit is off and the ON-OFF key is pressed, the controller will drive U10-6 high, which will enable power to the remainder of the instrument.

2. At power up, the micro controller will drive the beeper for about 1 second.

3. At power up, the micro controller will reset Shift Register U2. This will cause the following:
   a. The front panel LED's are blanked.
   b. The NIBP pump drive is placed in the off state.

4. When the unit is powered on the micro controller will communicate with the system CPU. When the front panel ON-OFF key is pressed, the CPU will store away present operating conditions, then issues a command to the micro controller to shut instrument power off. U10-6 is driven low which will remove power from the remainder of the instrument.

18V boost converter and FET ON/OFF switch

The PWM controller, U301, is configured as an 18V boost-converter. An N-Channel MOS-FET transistor, Q303, is used to switch power to the 12V regulator. As Q303 is configured as a high side switch, it is necessary to develop a gate voltage of proper magnitude to turn Q303 on. Then, to enable power to the 12V regulator, the following takes place:

1. The micro controller drives U10-6 high, turning transistor Q302 on.
2. Transistor Q301 is switched on, supplying power to the PWM controller, U301.
3. The boost regulator develops 18VDC, which will switch transistor Q303 On.

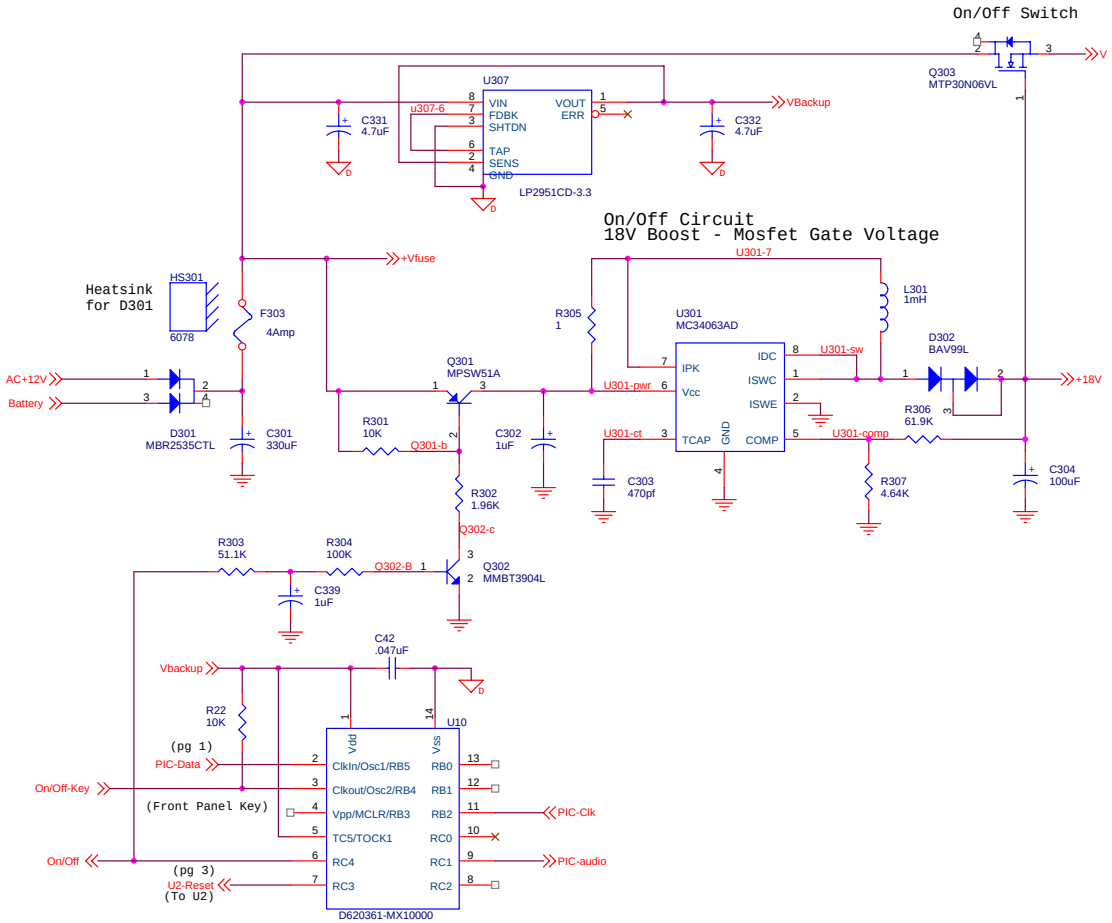


Figure A-6. Boost converter and off/on switch.

+12V Boost Converter

The +12V boost circuit provides regulated 12VDC. The input to the 12V converter is either battery or 12V from the AC/DC converter. The circuit is configured as a boost PWM using current mode feedback. The PWM controller is a UC3843A. The controller includes an internal 2.5V, 2% reference, and an external 5V, 2% reference. Nominal output voltage for the boost converter is Vout = [2.5V*(1 + 173.8K/4.64K)] = 12.1V.

The UC3843A requires 8.5V minimum to power on. The maximum voltage allowed on the switching transistor, Q305, is 15V. To meet both these requirements, the UC3843A is powered from 12.9V (+18V – 5.1V zener diode D303)

When operating from battery, the converter will run at duty cycles over 50%, which requires slope compensation for a current mode controller. Slope compensation is achieved by summing in part of the oscillator signal (pin 4) with the current sense line.

The PWM controller is current limited on a cycle to cycle basis by monitoring the voltage on the Isense line, U302-5. Current limit is activated when the voltage at the sense line reaches 1V. The nominal DC voltage at Isense is about 0.5V when operating from battery only, and 0.7V when operating from AC. Then, current limit is set to 5Amps when Atlas in operating on battery and 3Amps when operating on AC.

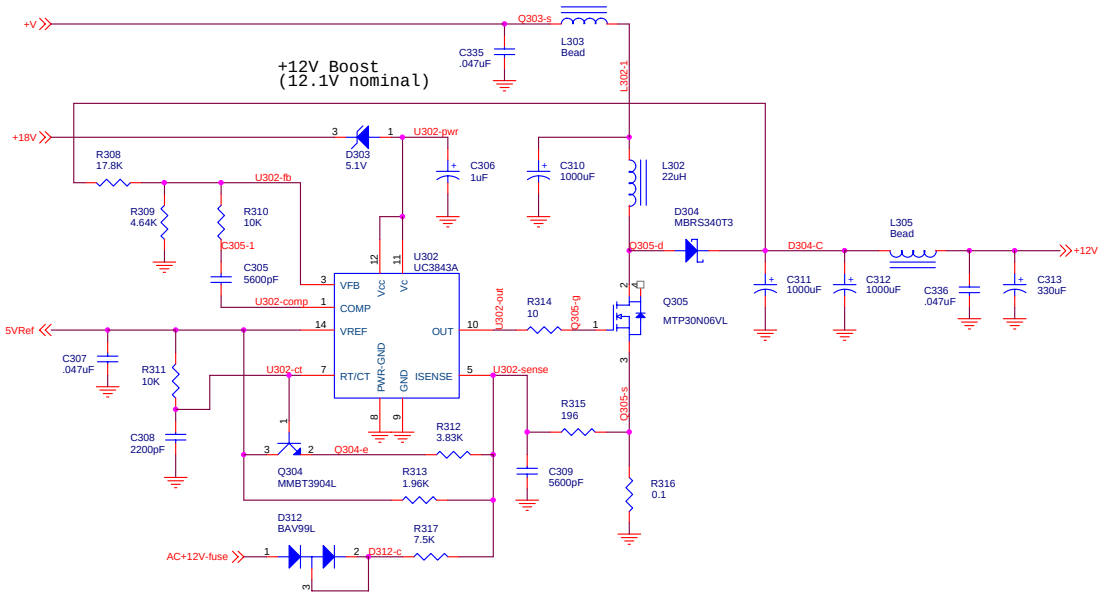


Figure A-7. Boost converter.

Battery Charger

The battery charger is a PWM buck converter. The input to the battery charger is 12VDC from the offline switcher. The UC3843A, normally a current mode controller, is configured for voltage mode feedback. The UC3843A has an under-voltage lockout for Vcc<8.5V. The controller operates such that with Vcc less than 8.5V, the reference out is 0V, and will be at 5V with Vcc>8.5V. Then, the reference out (pin 14) can be used as an AC-ON detect signal.

The switching transistor for the buck converter is a P-Channel MOSFET (Q308). The output drive of the controller is the wrong polarity for driving a P-Channel MOSFET in a step down mode. Therefore, transistor Q306 is added to invert the PWM out signal. Fast turn-on of Q308 is provided when Q306 is low, fast turn-off is though Q307 (configured as an emitter follower).

The battery charger is a current limited - temperature compensated charger. Current limit is set to 1.5Amps. Current through the 0.1Ohm sense resistor R327 is measured with Diff-Amp U305B. When the charger current is at 1.5Amps, feedback is controlled by Op-Amp U304A. When the current drops below 1.5Amps, the output of U304A goes low, reverse biasing Diode D308, and feedback will be controlled by Op-amp U304B.

Battery charge voltage is temperature compensated using Thermistor RT301, a 10K negative temperature coefficient resistor. Voltage over temperature follows the following charge profile:

Table A-1. Temperature coefficient.

Temperature	Voltage	Thermistor
0C	7.05V	26.9K
10C	7.0V	20.7K
25C	6.85V	10K
40C	6.7V	5.17K
50C	6.65V	3.45K

For optimum battery life, the float voltage (25C, full charge) should be set to 6.85V +/- 50mV (6.85V +/- 0.7%). To accomplish this tight tolerance, charge voltage at room temperature will be adjusted with potentiometer R328. Nominal charge voltage at room temperature is:
Vcharge = 5V * (1 + RA/RB) where,
5V is the reference in U303.
RA is the series/parallel combination of R335, R336, and RT301 (nominal 3.465K @ 25C).
RB is the series combination of R337and R338 (nominal 936 Ohms)

It is necessary to minimize current out of the battery when the unit is off. To reduce off current, transistor Q309 disconnects the battery from the battery sense resistors when AC in off. In addition, diode D307 is added to prevent current from flowing from the battery into the battery current sense circuit, and to the output of the AC/DC converter.

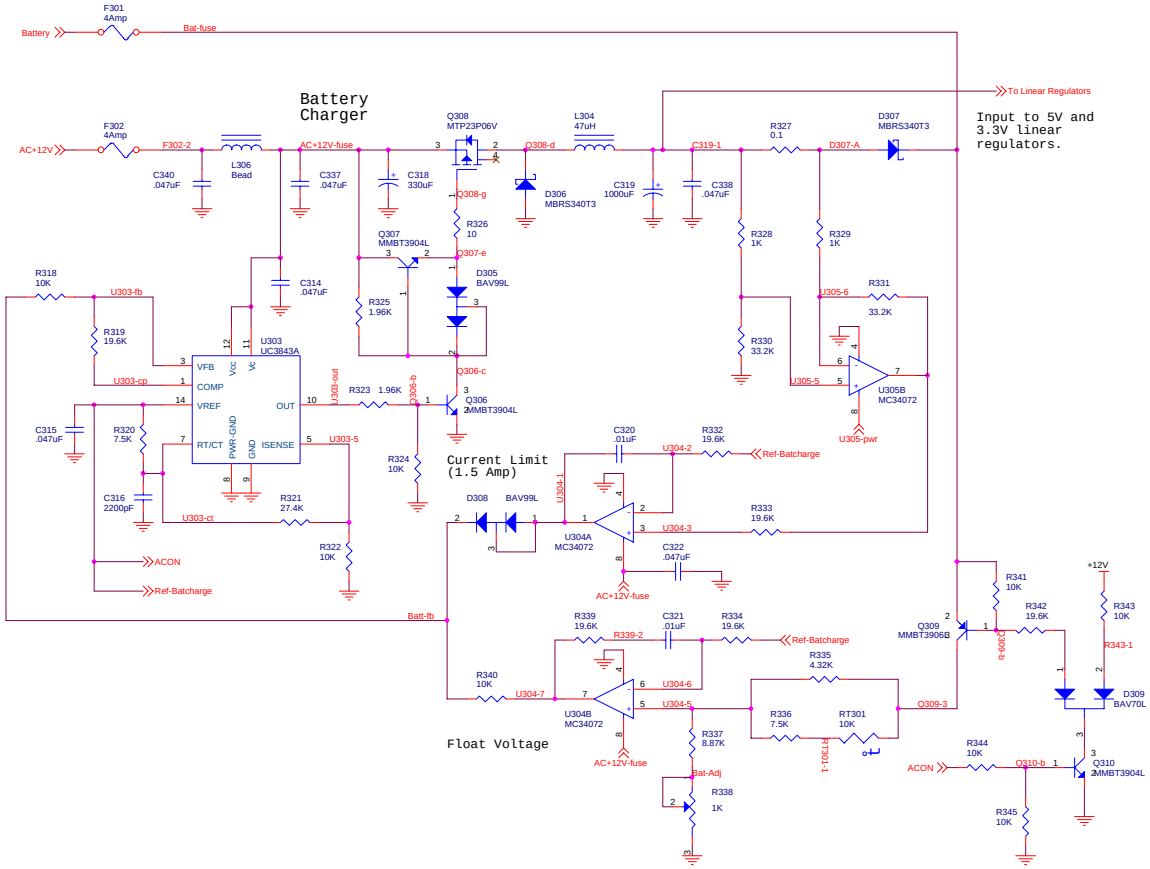


Figure A-8. Battery charging.

Linear Regulators – 5VDC and 3.3VDC

A series pass 5V regulator is built using transistor Q312 and op amp U305A. A 5V reference from U302 PWM IC) is used as the control voltage for the regulator. The output of the 5V regulator is turned off when the unit is turned off. When the 18V-boost circuit is shut down, power is removed to U302, then the U302 reference is driven to 0V. Setting the reference to 0V will cause op amp U305 to turn the series pass transistor Q312 off.

When operating from AC, transistor Q310 is turned on, which will turn transistor Q311 off. Power to the 5V regulator is then provided through Diode D310 from the output of the battery charger circuit. Note that this voltage tap is before the current sense resistor, then load current on +5V does not affect the battery charger current limit circuit. When AC is removed, the AC-On signal goes low, and Q310 turns off. The gate of Q311 is then pulled up to 11.4V (12V – Vdiode). Transistor Q311 then turns on, and the 5V regulator is powered from the battery.

3.3VDC is derived using a three terminal regulator. The output of the 5V regulator is used to power the 3.3V regulator. The 3.3V regulator does not have an independent shutdown, but powers down as the 5V regulator shuts down.

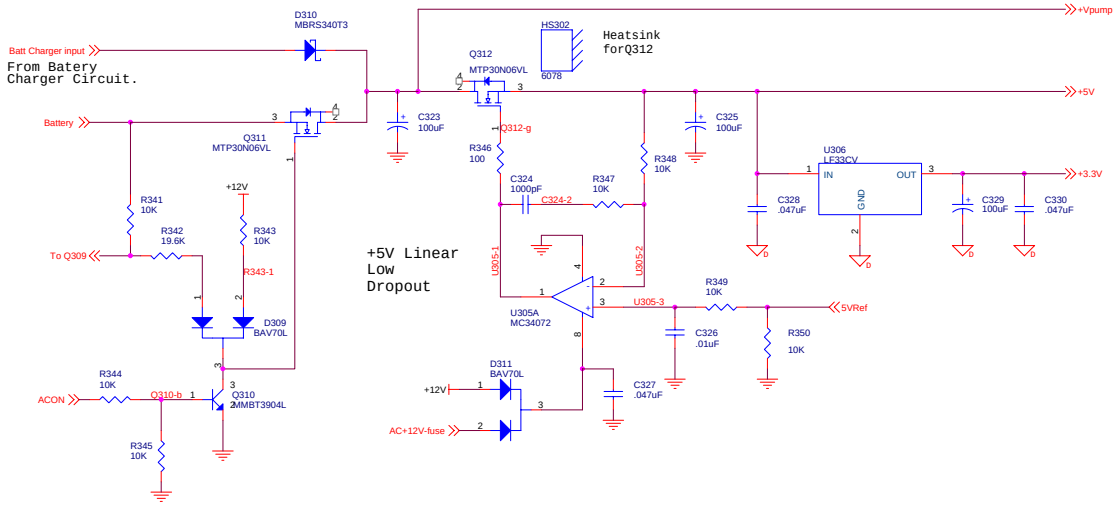


Figure A-9. Linear regulator.

A/D – grounded circuits

The A/D converter is designed by building a pulse width modulator (PWM) and a timer circuit. The PWM runs at a 1.2KHz rate, synchronized by the A/D sync signal (NIBP-ADC-Clock). A/D sync is low for 52.1uSec, high for 781.25uSec. Component values are selected such that the integrator will ramp down 4.7V, and ramp up 7.83V. The voltage at the integrator output (U601-1) is limited to about 5V [5V*(73.2/83.2) + Vdiode)]. Then, the integrator starts at 5V and ramps linearly down to 0.3V.

The analog input voltage to be digitized and the integrator output are the inputs to comparator U210. The output of the comparator is low at the start of an A/D cycle, and switches high as the integrator ramp drops below the input voltage being digitized (see the timing diagram below). A/D conversion is accomplished by measuring the width of the PWM output signal. The A/D timer runs at 25.175MHz, then the A/D resolution is about 21000 counts (over 14 bits). Note that since the output of the comparator is low at the start of the A/D cycle, a resistor divider is formed at the comparator input. This divider reduces the Analog-In signal by 0.75% [464K/(464K+3.48K)].

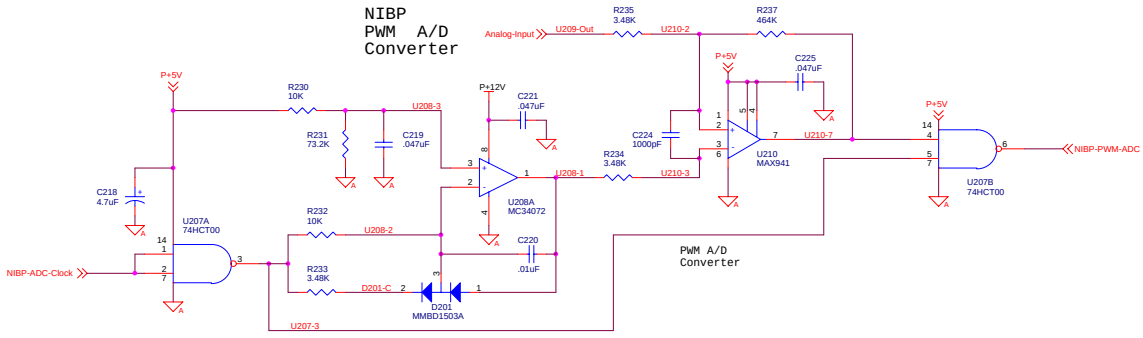


Figure A-10. NIBP PWM A/D converter.

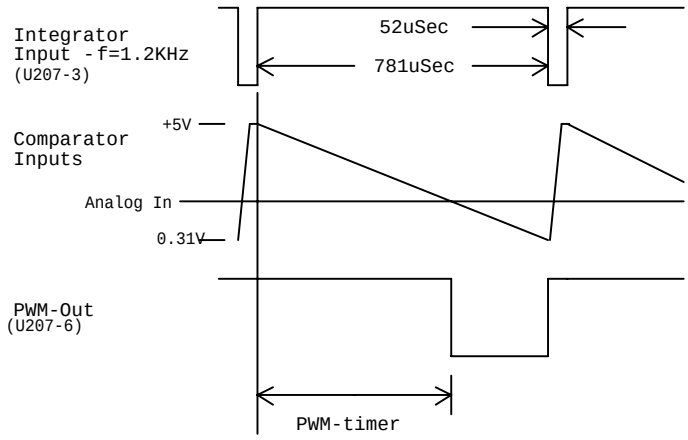


Figure A-11. PWM timing.

A/D Mux – grounded circuits

Analog signals are switched to the A/D converter through MUX U209. Control of the multiplexer is through a serial communication channel from the main CPU. The following signals are digitized:

+5V/2	Sampled version of the 5V supply. Used to verify A/D operation.
SafetyPres	Safety Pressure Transducer
PrimaryPres	Primary Pressure Transducer
P.75V	Reference voltage for A/D calibration. 0mmHg pressure for Primary Transducer.
P4.25V	Reference voltage for A/D calibration. 300mmHg pressure for Primary Transducer.
Print-Temp	Printhead Temperature, used to compensate printer strobe width.

Model 622/623: Vbatt Battery Voltage, used to warn of low battery condition
Model 621: Not Used.
Model 622/623 BattCurrent: Battery charger current, used in service mode verification.

Model 621	LithMeas Backup Battery voltage (Lithium Battery) Used to warn user of low backup battery condition.

NIBP Circuits

Overview - Safety:

Two pressure transducers are used, a primary and safety transducer. The primary is used to make all BP measurements. Hardware circuits monitor the output of the primary transducer, looking for overpressure faults. In addition, Software monitors the digitized outputs of the primary transducer, and detects overpressure faults. The following overpressure faults are detected in software (monitored once per second):

>=10mmHg pressure for 295 seconds
>=15mmHg pressure for 175 seconds
>295mmHg pressure for 0.5 seconds.

Software detected overpressure faults are considered application faults. The user is warned of a fault with an audible alarm and a 'Check blood pressure cuff' message on the CRT display. NIBP is not disabled for this type of fault. In the event of a fault, the drive signals to the NIBP pump and valve are opened.

Two hardware faults are detected, pressure over 330mmHg (nominal trip point 314mmHg, and pressure over 15mmHg for three minutes (13.3mmHg nominal trip point). These faults are considered more serious (since software should have detected and corrected this condition). The user is notified with a 'BP SYSTEM FAULT' message, and NIBP is disabled. A redundant safety transistor is opened to ensure the NIBP pump is off and the valve is open.

The primary and safety transducer outputs are continuously digitized. The outputs of the transducers are checked vs. each other, and if they disagree, an 'NIBP Fault Message' is declared and the NIBP system is disabled. The outputs of the transducers are linearly proportional to the supply voltage (supply current for the safety transducer). The transducers use unique reference voltages to ensure that a fault in one reference will not cause an equivalent gain error in both transducers.

The A/D also has redundant checks. Two reference voltages (derived from the primary transducer reference supply) are measured, and the A/D gain and zero is checked. In addition, a unique reference is digitized, and compared vs. expected results. An error in any of these A/D measurements will again cause an 'NIBP Fault Message', and the NIBP system will be disabled.

Primary Transducer - Amplifier:

The primary pressure transducer is a fully calibrated and compensated transducer with built in voltage amplification. The output of the transducer is proportional to the supply voltage. With a 5V supply, the output of the transducer is:
0mmHg = 0.5V.
300mmHg = 4V.
Op amp U204A is used to level shift the output of the transducer such that the nominal voltage for 0mmHg is set to 0.75V. The CPU monitors the digitized zero pressure voltage, and any offset is corrected. This correction comes from the summation of an error correction signal through op amp U204B. The CPU will output a pulse width modulated signal at 76.8KHz. This signal is RC filtered to provide ad DC voltage at U204-5. This signal can adjust the offset seen at the A/D converter by +/-20mmHg.

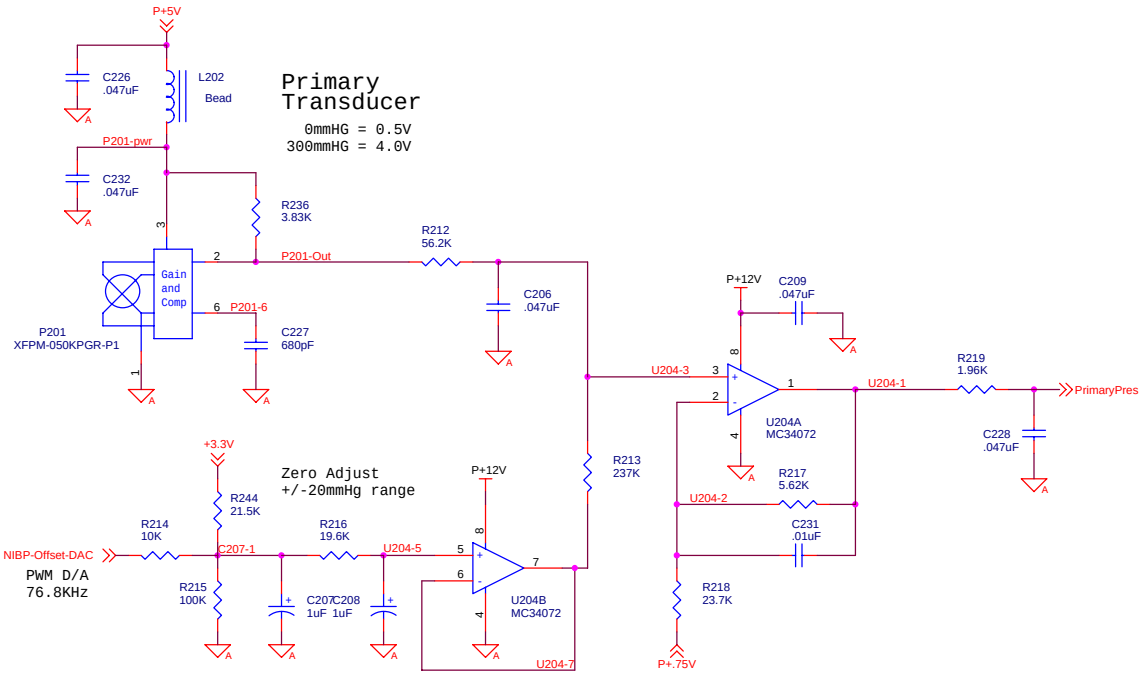


Figure A-12. Primary transducer amplifier.

Safety Transducer - Amplifier

The safety transducer is compensated for temperature drift, but gain and zero are not calibrated. The safety transducer does not include built in voltage amplification. The safety transducer output is a differential voltage, proportional to the supply current through the device.

The initial accuracy of the safety transducer is very loose, in the order of +/-50%. However, the drift over time and temperature is very good. Then, it is necessary to calibrate the output of the safety transducer. This is done my measuring a know pressure, measuring the output of the safety transducer, and storing calibration constants in NVRAM. A two-point calibration procedure is used. Calibration is done at the factory, and can be recalibrated in the field if necessary.

Current Source:

Op amp U205A is configured as a current source for the Pressure Transducer, with the current through the transducer set to 1.5mA. Nominal gain for the transducer is 300mmHg = 75mV.

Differential Amplifier and Offset Centering:

The output of the safety transducer is a differential voltage, with a nominal gain of 0.25mV/mmHg, and a zero pressure offset voltage of +/-25mV. The A/D converter has an input voltage range of 0.5V to 5V. It is necessary to both add both signal gain and offset centering to the transducer output before digitalization.

Op amp U206A/B is configured as a differential amplifier, with a voltage gain of 22.5. The output of the differential amplifier is offset by 1.2V (U205B).

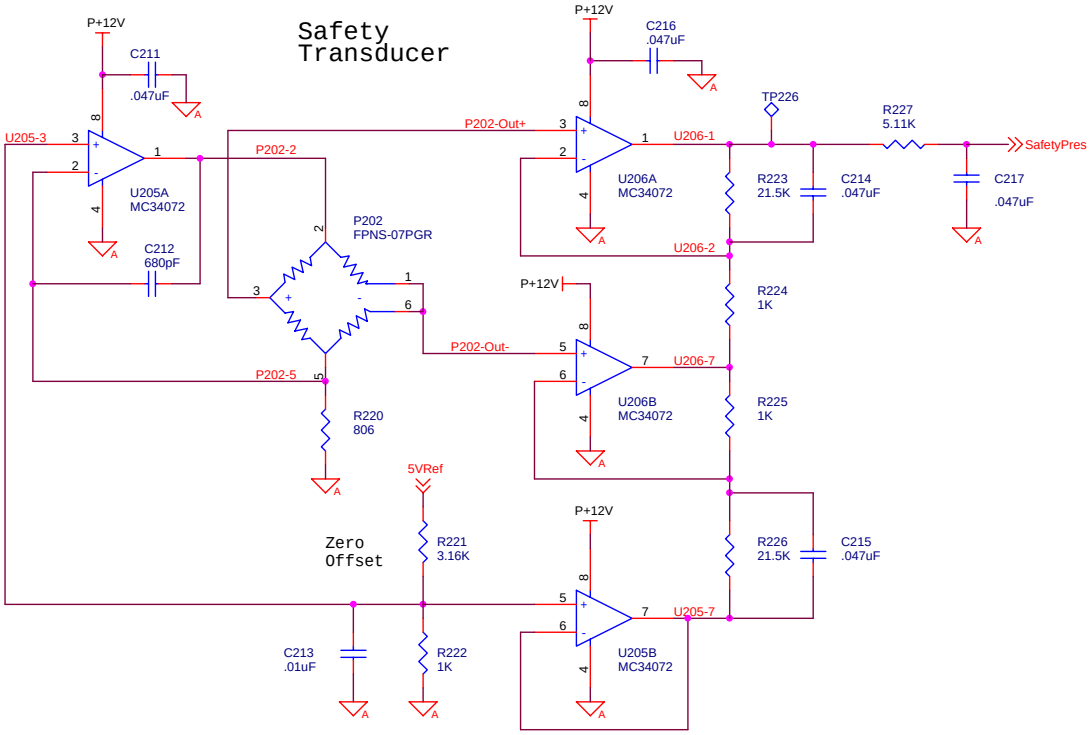


Figure A-13. Safety transducer amplifier.

Hardware Overpressure:

The output of the primary transducer is monitored for two overpressure conditions; pressures in excess of 13.3mmHg (nominal) and 314mmHg (nominal) are detected. These error conditions are transmitted to the gate array on the CPU board, and if the error conditions are present for a long enough time period, a fault message is displayed, and NIBP is disabled (see above for safety performance operation).

The output of the Primary Transducer drives the two comparators U203A/B. The comparison voltage is derived through a resistor divider chain from a 5V regulator (U201). This regulator is the supply voltage for the primary transducer, and sense the primary output is proportional to the supply voltage, tolerance errors in the regulator are not critical.

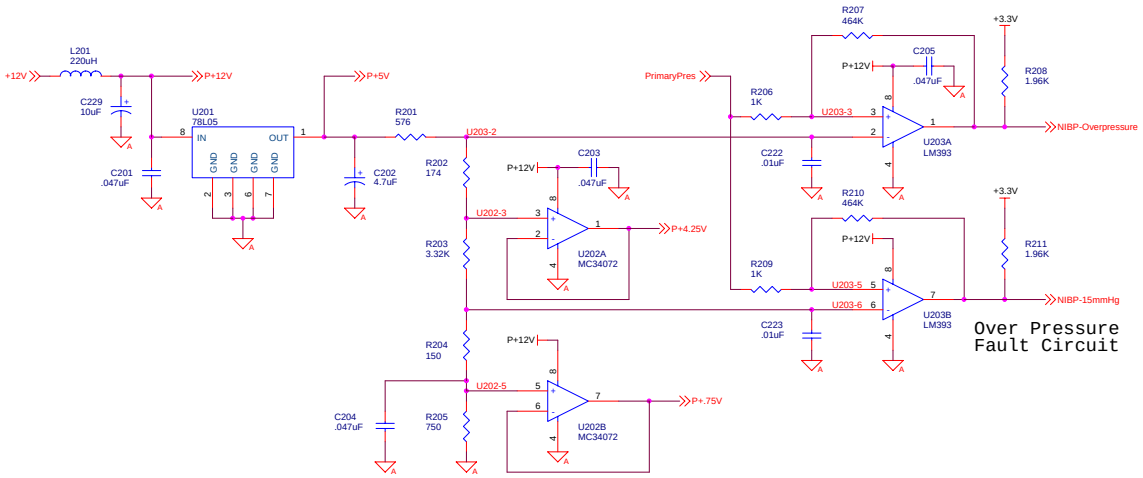


Figure A-14. Over pressure fault circuit.

Pump and Relay Drive:

Two independent dual transistor switches, Q202 and Q203 control the pump and valve. Q202 is controlled by logic circuits on the CPU board, and is normally in the on state. Q202 is only opened in a fault condition (over pressure, A/D calibration error, or transducer mismatch). Once a fault is detected, Q202 will remain open until power is cycled. Under normal operation, dual transistor Q203 is used to switch the pump on and close the valve. The pump-on and valve-close commands are controlled by software. Note that the valve is normally open. Then, in the case of no power, the valve will be in the open state.

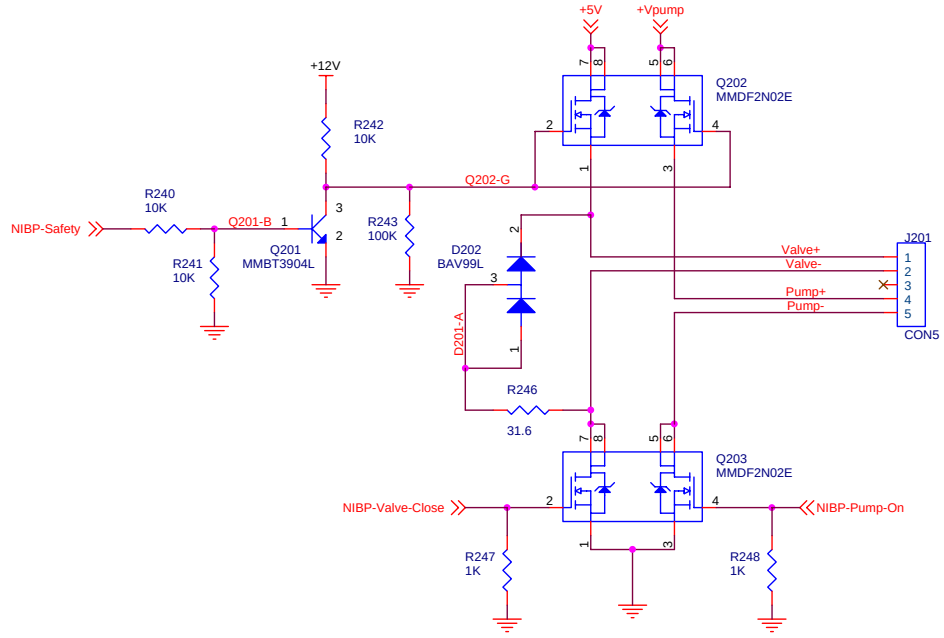


Figure A-15. Pump relay circuit.

Note: *Model 621 uses a single Mosfet for transistor Q202, with the drain connected to +6V, and the source connected to nets 'Pump+' and 'Valve+' through a series diode.*

CRT Deflection Board

Overview:

Atlas uses a 5-inch monochrome CRT display. This CRT will display Waveform Data (ECG and Respiration or SpO2 or $ETCO_2$), plus Text Data (Heart Rate, Alarm Values, Trend Data, setup, and service menus). The CRT Deflection board performs the following functions:
1. Vertical Deflection.
2. Horizontal Deflection.
3. CRT Grid Voltages.
4. Video Amplifier.

CRT Deflection is magnetic, vertical and horizontal deflection is controlled by regulating current through the vertical and horizontal coils of the CRT Yoke. The Deflection board is designed to the following specifications:

Resolution: VGA (640X480)
Dot Clock: 39.7nSec (1/25.175Mhz)
Display Size: 100mm (Horizontal) X 68mm (Vertical)

Vertical: Scan Rate: 60Hz
Reset Time: 750uSec
Blanking Time:1.2mSec

Horizontal: Scan Rate: 31.5Khz
Reset Time: 5uSec
Blanking Time: 5.7uSec

Vertical Amplifier:

Ramp Generator:

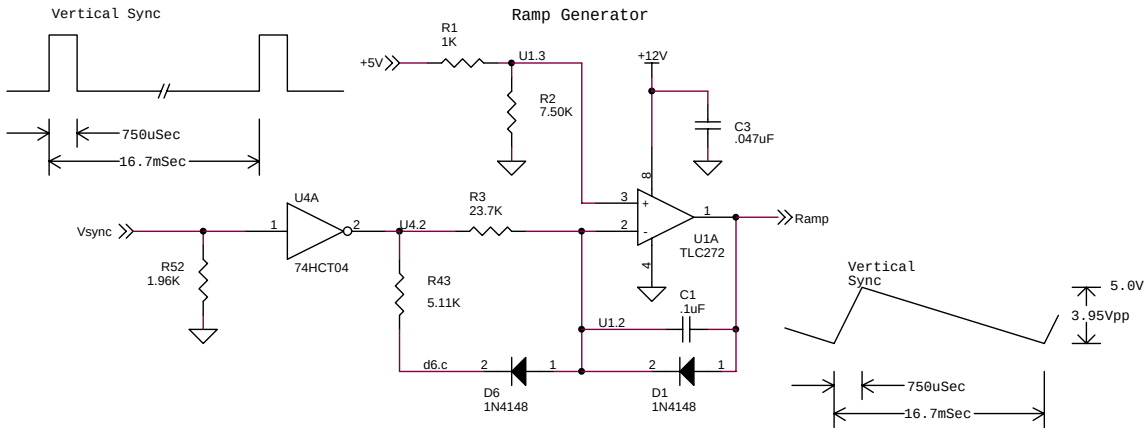


Figure A-16. Ramp generator circuit.

A ramp generator is built from the integrator (U1A, C1, and R3). The slope of the integrator

is: V = (I*T)/C. The integrator is designed so that it ramps up 6.97V in 750uS and ramps down 3.95V in 15.9mS. Diode D1 clips the output voltage at about 5.0V (U1-pin3 + Vdiode). Then the ramp resets at 5.0V each cycle, and integrates down 3.95V.

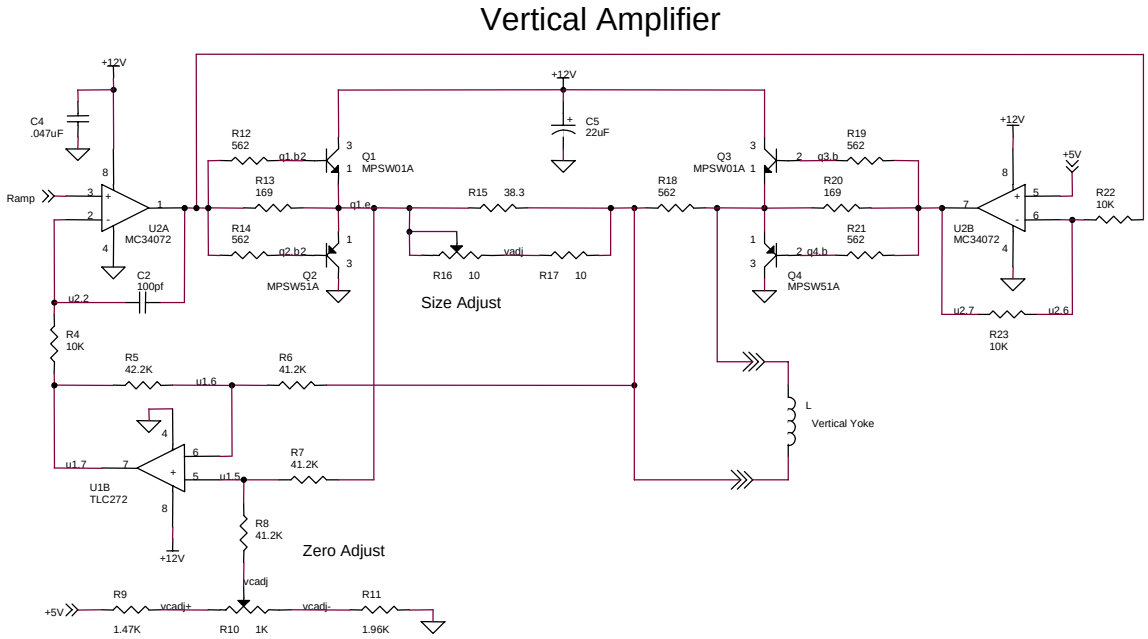


Figure A-17. Vertical amplifier circuit

Vertical Amplifier:

The Vertical amplifier will generate a linear current ramp of +/-200mA. The vertical amplifier is an H-Bridge type driver. Positive current flow (deflecting the beam above the centerline) is defined as current from +12V to Q1 to Rsense through the coil to Q4 to Ground. The negative current path is from +12V to Q3 through the Coil to Rsense to Q2 to Ground.

The input to the vertical amplifier is the ramp voltage generated above. The objective of the vertical amp is to match the current through the vertical coil with the input ramp control voltage. Current through the vertical coil is monitored through the sense resistor, formed from R15, R16, and R17. Voltage across the sense resistor is measured with the differential amplifier U1B. This voltage is then used as the feedback voltage to the control opamp, U2A.

Zero Adjust:

The output voltage from the ramp generator is a ramp from 5.0V to 1.05V (nominal). The center of this ramp is 3.0V. Then, the output of the current sense diff amp must be offset by 3.0V. This is accomplished with the Zero Adjust Network, Resistors R9, R10, and R11. Vertical centering is then accomplished by writing a pattern to the CRT, and adjusting R10 to center the display.

Size Adjust:

Adjusting the current through the Vertical Coil changes vertical deflection. The voltage across the sense resistor is:
Vsense = (Vramp-Voffset) / 1.02 (1.02 is the gain of the current sense diff amp)
Current through the coil is equal to current through the sense resistor network.
coil = Isense = Vsense / Rsense
Then, adjusting the value of the sense resistor will change the current through the vertical coil. Vertical gain is then accomplished by writing a pattern to the CRT, and adjusting R16 to set vertical deflection.

Horizontal Amplifier:

Current through the transformer increases linearly as Transistor Q6 is On (I = VdT/L). When the transistor opens, the drain voltage kicks up, and the current through the Transformer coil flows through C9, L2, L3, and the Horizontal Coil to Ground The transformer quickly loses flux (reset time < 5uSec). Current continues to flow in load inductance, from Ground through Q6-diode, C9, L2, L3, and the Horizontal Coil to Ground. This current flow charges capacitor C9. The current decreases linearly to 0, then changes directions. This is due to the AC coupling capacitor C9 being charged to a negative voltage. Current flow is then from Ground through the Horizontal Coil, L2, L3, C9, and Q6 to Ground.

The drive to MOSFET Q6 is AC coupled. This will prevent Q6 to be driven high in the event of a faulty driver on the CPU board.

In order to get adequate deflection current (about +/-2.3Amps), 18.5V across the transformer coil is necessary. A “boost” winding is added to the transformer, then when the voltage on the transistor drain flys up, current flows into capacitor C11. C11 charges to a voltage determined by the turns ratio in the transformer.

Horizontal Gain:

Horizontal deflection is adjusted by changing the current through the Horizontal coil. Changing the series inductance in the Horizontal Deflection Path modifies the current. Increasing Horizontal gain is then accomplished by writing a pattern to the CRT, and adjusting the “width coil”, L3.

Horizontal Centering:

Horizontal centering is accomplished by rotating magnets mounted on the CRT Yoke assembly.

Grid Voltages:

The following voltages are developed to bias the grids on the CRT:
Grid 1: 10V to -50V DC (Brightness Adjust)
Grid 2: 350VDC
Grid 4: 0V to 350VDC (Focus Adjust)
Anode: 7.5KV

These voltages are derived from additional windings on the FBT. In addition, the supply voltage for the video amplifier (+36VDC) is generated from a tap on the FBT.

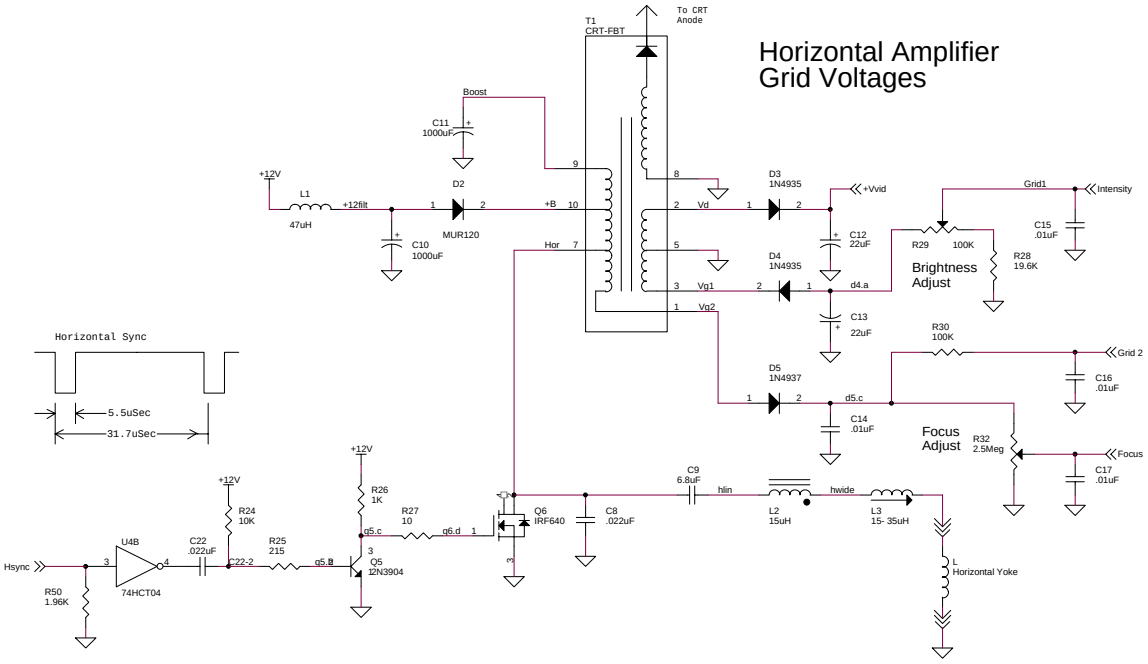


Figure A-18. Horizontal amplifier grid voltage circuit.

Video Amplifier:

The CRT tube turns a dot on when video out is low (near 0V), and off when video out is high (+Vvid = 28V). The input to the video amplifier is a digital signal (3.3V logic level) from the uProcessor. An input of 0V turns the dot off, an input of 3.3V turns the dot on. Transistor Q7 amplifies and inverts this signal. Video out is driven low through D7, and driven high through emitter follower Q8. .

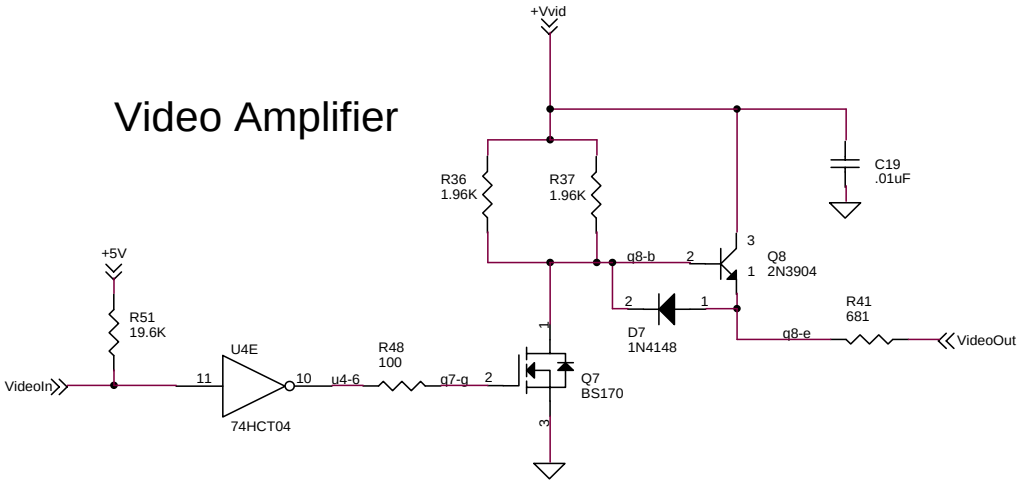


Figure A-19. Video amplifier circuit.

Recorder Electronics

Overview:

Atlas includes a thermal strip chart printer (optional on Model 200 and 210, standard on model 220). The user can print either annotated waveform data or Patient trend information.

The printer specifications are:

Paper Size: 56 or 58mm (2 1/4 inches)
Printhead Width: 54mm (2 1/8 inches)
Resolution: Vertical: 8 dots/mm, (200 dots/inch)
Horizontal: 12 dots/mm (300 dots/inch)
Chart Speed: 25mm/sec (1 inch/second)

The main CPU controls the printer. Data timing, clock signals, and strobe widths are all generated by the FPGA on the CPU board. These signals are buffered on the recorder board (inverter U5), before transmission to the printhead.

Power Supply – 24 Switcher

It is necessary to generate 24VDC for the print head and motor. The input to the 24V switcher is either 12V from the AC/DC converter, or Battery voltage on the model 210/220 when AC is not present. The circuit is configured as a boost PWM using current mode feedback. The PWM controller is a UC3843A. The controller includes an internal 2.5V, 1% reference, and an external 5V, 1% reference. Nominal output voltage for the boost converter is Vout = [2.5V*(1 + 84.5K/10K)] = 23.6V.

The converter will run at duty cycles over 50%, which requires slope compensation for a current mode controller. Slope compensation is added by summing in part of the oscillator signal with the current sense line.

The PWM current limits on a cycle to cycle basis. The supply will be in current limit when the Isense line reaches 1V. Current limit is set to about 3.5 Amps from 12VDC or 5Amps from battery.

Two control signals exist for the 24V switcher, n24Von and Rec-Supply-On. The 24V switcher is disabled when n24Von is high. This signal is controlled by the on board PIC processor. The switcher is held off at power up, and allowed to start after 50mSec. This is done to reduce inrush current at power up. The signal Rec-Supply-On enables power to the print head, and is controlled by the main CPU. Power is only applied to the print head when the recorder is running.

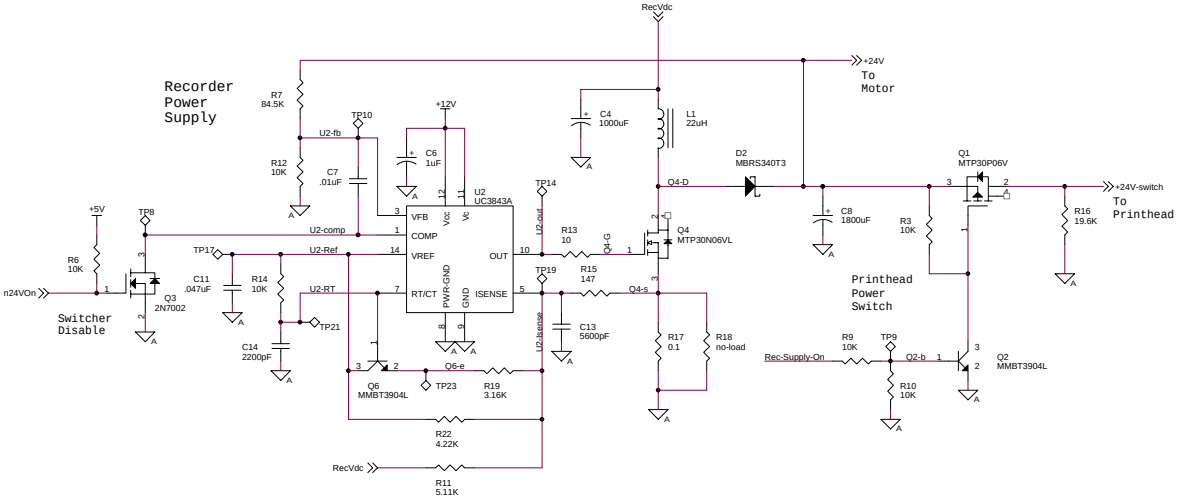


Figure A-20. Recorder power supply circuit.

Motor Driver:

Atlas uses a stepper motor to drive the paper. The microcontroller (U3) is programmed to apply the appropriate phased signal to the motor. A quad darlington switch (U6) amplifies the signal from the controller to signal levels needed to drive the motor. Motor speed timing is derived from the main CPU, and transmitted to U3 on signal line U3-clk (U2-pin2).

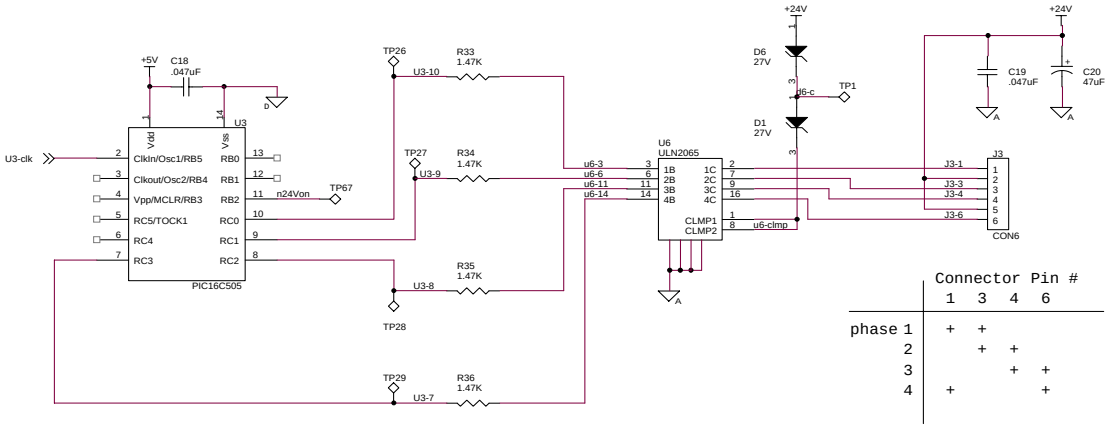


Figure A-21. Printer motor drive circuit.

Temperature Amplifier:

The printer will print darker as temperature is increased. Print darkness can adjusted by controlling the time a dot is turned on. A thermistor is included on the printhead. This thermistor is nominally 30K, and decreases as temperature increases. The output of the temperature amplifier is a function of the thermistor voltage, Temp = .755*(1+R8/Rtherm). This voltage is digitized (on the main board), and the CPU can compensate dot width in order to maintain consistent printing over temperature.

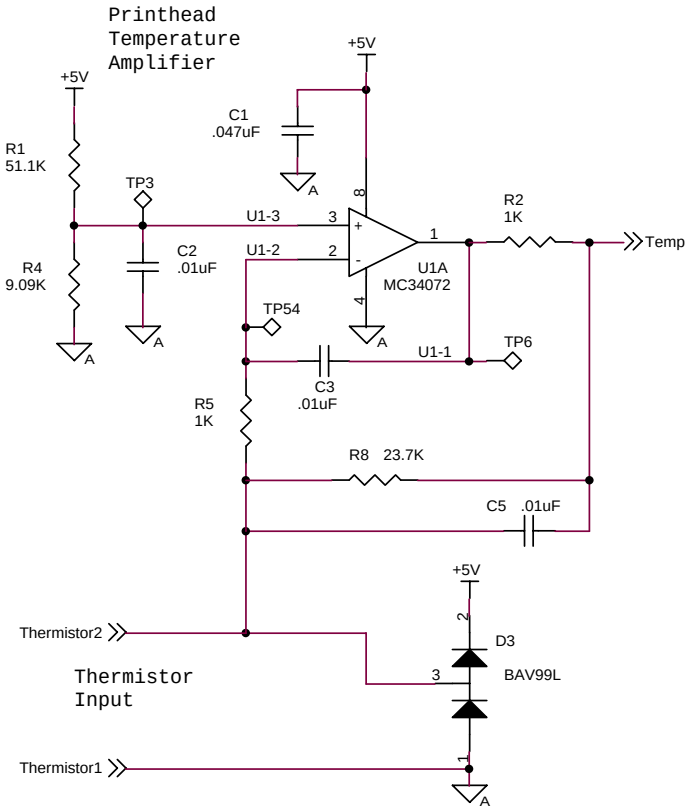


Figure A-22. Print head temperature circuit.

Patient Isolated Circuits

Isolated Power

Isolated power is provided to the ECG, SpO2, Temperature, and Impedance Respiration circuits using an Isolation Transformer T401 (temperature and respiration on models 622 and 623 only). The power supply is a PWM controlled flyback converter. The PWM controller is an LM3524. Output voltage f+V is sampled and compared with a 5V reference voltage. An error voltage is generated, and this voltage returned via opto U410. Voltage f+V is regulated to 7.4V. A second tap on transformer T401 provides f-V (-7.4V). The switcher operates at 76.8KHz, controlled by a sync signal from the CPU board. The power supply is synchronized with the A/D converter used to digitize ECG, Temperature and Respiration signals.

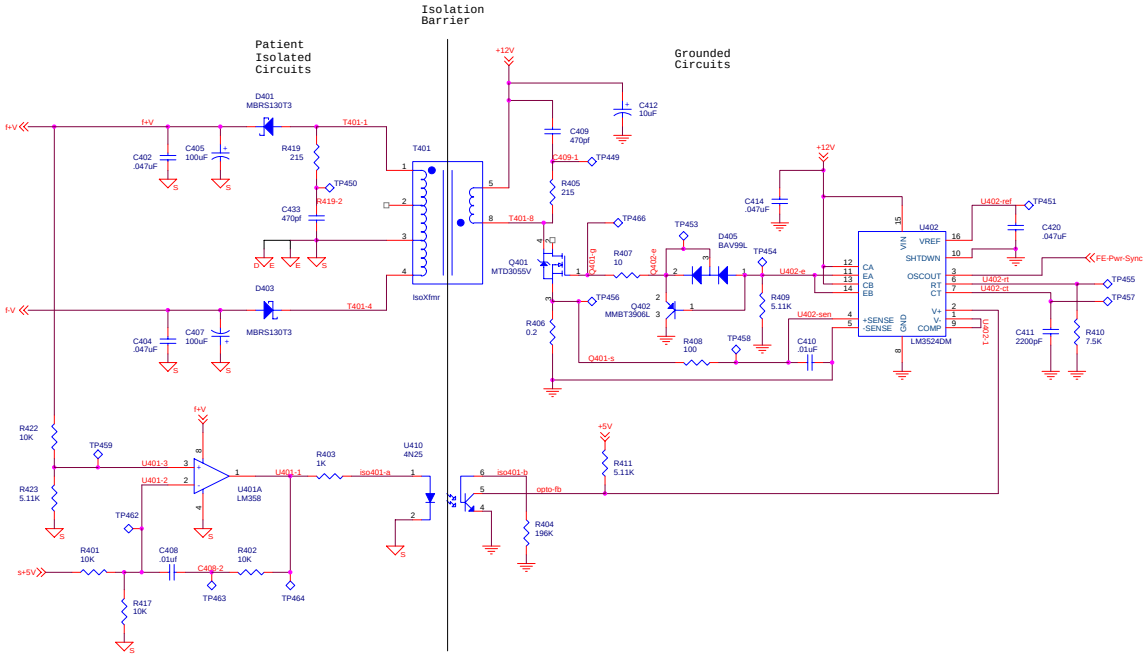


Figure A-23. Patient isolation circuit.

Linear Regulators and Filtering – Model 621

From the raw f+V and f-V voltages (labeled fVcc and fVee on model 621), the following supplies are generated for the various patient isolated circuits:
iso+5dig: Regulated 5V supply. This voltage is used to power the opto-isolators and digital control logic. This is also the reference voltage used in the regulation of f+V.
f+5V: Regulated +5V supply: Filtered and buffered from iso+5dig, this voltage is used for the A/D reference.
fVcc: This voltage is used to power the Op-Amps used in the ECG and A/D circuits. This voltage also powers the Nonin SpO2 electronics.
fVee: This voltage is used to power the Op-Amps used in the ECG and A/D circuits.

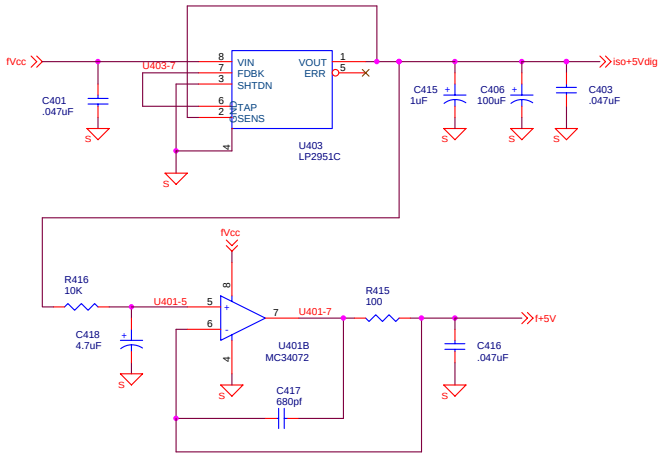


Figure A-24. Model 621 line regulation and filtering.

Linear Regulators and Filtering – Model 622 and 623

From the raw f+V and f-V voltages, the following supplies are generated for the various patient isolated circuits:
iso+5dig: Regulated 5V supply. This voltage is used to power the opto-isolators, digital control logic, and 5V digital supply for the Nellcor SpO2 board.
s+5V: Regulated +5V supply: Analog 5V supply for the Nellcor SpO2 board. This is also the reference voltage used in the regulation of f+V.
f+5V: Regulated +5V supply: Filtered and buffered from s+5V, this voltage is used for the A/D reference.
s-5V: Regulated –5V supply: Analog –5V supply used for the Nellcor SpO2 board.
fVcc: LC Filtered voltage, derived from f+V. This voltage is used to power the Op-Amps used in the ECG, Respiration, Temperature, and A/D circuits.
fVee: LC Filtered voltage, derived from f-V. This voltage is used to power the Op-Amps used in the ECG, Respiration, Temperature, and A/D circuits.

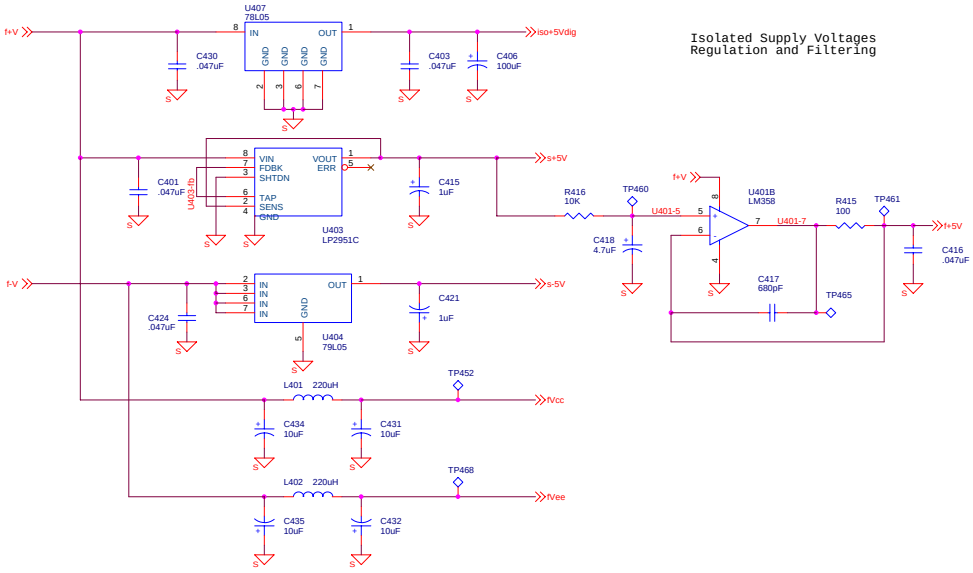


Figure A-25. Model 622/623 line regulation and filtering.

A/D Circuits

M A/D

A pulse width modulator is used as an A/D converter. The PWM runs at a 1.2KHz rate, synchronized by the A/D sync signal. A/D sync is low for 52.1uSec, high for 781.25uSec. Using the values shown, the integrator will ramp down 10.01V, and ramp up 25V. The voltage at the integrator output (U601-1) is limited to about 5V [5V*(73.2/83.2) + Vdiode)]. Then, the integrator starts at 5V and ramps linearly down to –5V.

The analog input voltage to be digitized and the integrator output are the inputs to a comparator. The output of the comparator is low at the start of an A/D cycle, and switches high as the integrator ramp drops below the input voltage being digitized (see the timing diagram below). A/D conversion is accomplished by measuring the width of the PWM output signal. The A/D timer runs at 25.175MHz, then the A/D resolution is about 21000 counts (over 14 bits). Hysteresis is added to the comparator to avoid oscillations during switching. Note that since the output of the comparator is low at the start of the A/D cycle, a resistor divider is formed at the comparator input. This divider reduces the Analog-In signal by 0.75% [464K/(464K+3.48K)].

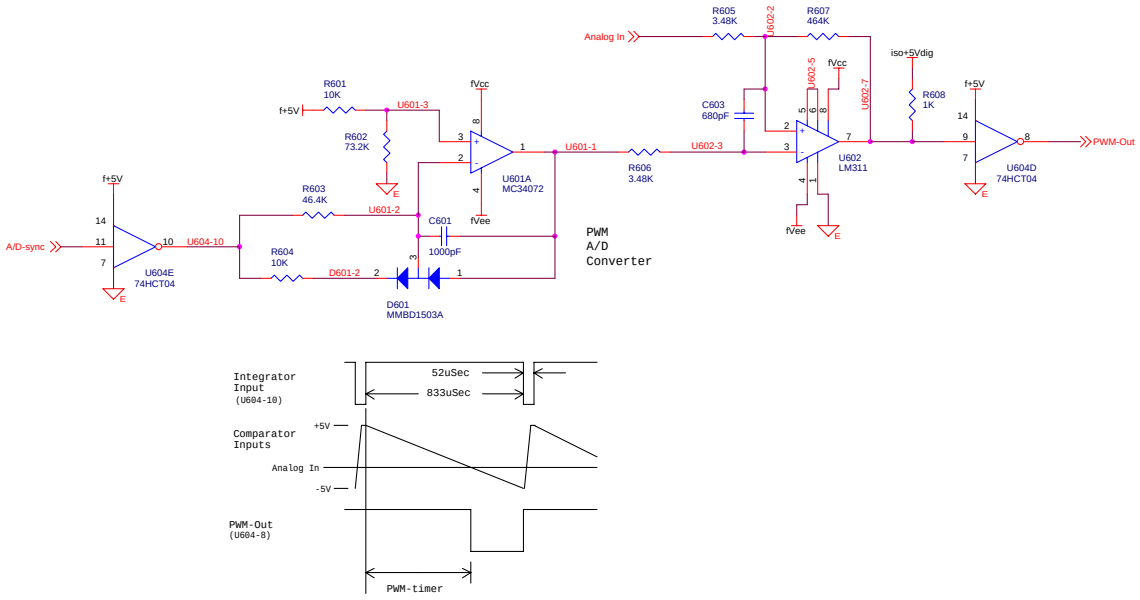


Figure A-26. A/D converter circuit.

A/D Multiplexer

The model 621 uses an 8-channel multiplexer, the model 622/623 uses a 16-channel multiplexer, to select the analog signal to be digitized. Control of the multiplexer is through a serial communication channel from the main CPU. The following signals are digitized:

Ground	Ground Reference for digitized signals, used in calibrating the A/D converter
ECG	Amplified ECG signal
V Buffer	Output of the V-lead buffer, used to determine leads off
LL Buffer	Output of the LL-lead buffer, used to determine leads off
LA Buffer	Output of the LA-lead buffer, used to determine leads off
RA Buffer	Output of the RA-lead buffer, used to determine leads off
f1.24V	Reference Voltage, used in calibrating the A/D converter
RL Output	Output of the RL amplifier
Patient Temp	Analog voltage representing patient Temperature (model 622/623 only)
Respiration	Amplified Respiration signal (model 622/623 only)
Resp Leads Off	DC impedance for respiration, used to determine respiration Leads off (model 622/623 only).

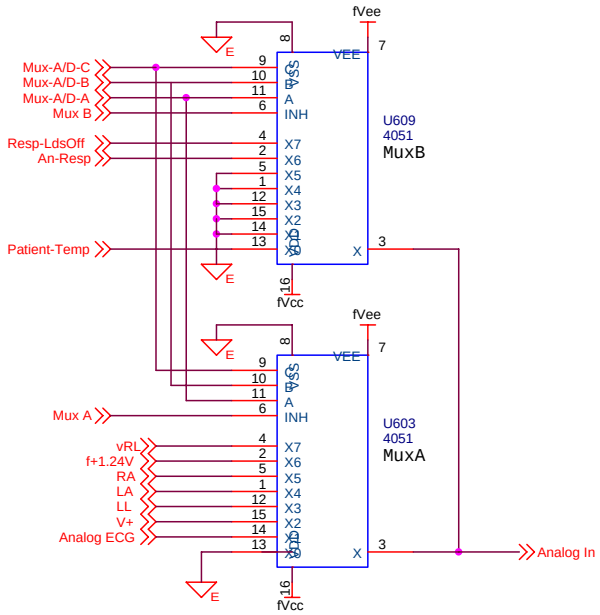


Figure A-27. A/D multiplexer circuit.

Note: *U609 not used in model 621.*

Serial Communication

Serial data is transmitted to the isolated circuits through Optical Isolators. The following signals are transmitted from the CPU board to the isolated circuits:

1. FE-Serial-Data: Serial Data transmitted from the CPU board to the Isolated circuits.
2. FE-Data-Clk: Serial Data Clock.
3. A/D Clk: Serial Data latch. Also used as clock for PMW A/D converter.

Serial Data is converted to a parallel format using Shift Register U605 and U606. The following Data is transmitted from the CPU board to the isolated circuits:

1.	Mux-A/D-A	Control bit A for A/D Mux
2.	Mux-A/D-B	Control bit B for A/D Mux
3.	Mux-A/D-C	Control bit C for A/D Mux
4.	Mux-Lds-A	Control bit A for ECG Lead Select Mux
5.	Mux-Lds-B	Control bit B for ECG Lead Select Mux
6.	Mux-Lds-C	Control bit C for ECG Lead Select Mux
7.	Sw-RLD-RA	Switch Reference Electrode to RA
8.	Sw-RLD-LA	Switch Reference Electrode to LA
9.	Sw-RLD-LL	Switch Reference Electrode to LL
10.	Sw-RLD-RL	Switch Reference Electrode to RL
11.	MonBW	Select 0.5Hz ECG high pass pole (used to restore ECG baseline).
12.	MuxB	0 – Select A/D Mux B; 1 - Select A/D Mux A
13.	Sw-RLD-V	Switch Reference Electrode to V
14.	Sw-RespReset	Switch Respiration High Pass Pole, used to restore baseline (model 622/623)
15.	SpO2Reset	Reset Nellcor SpO2 board (model 622/623 only)
16.	Resp-Off	Turn respiration off when respiration not used (shuts down drive signal) (model 622/623 only).

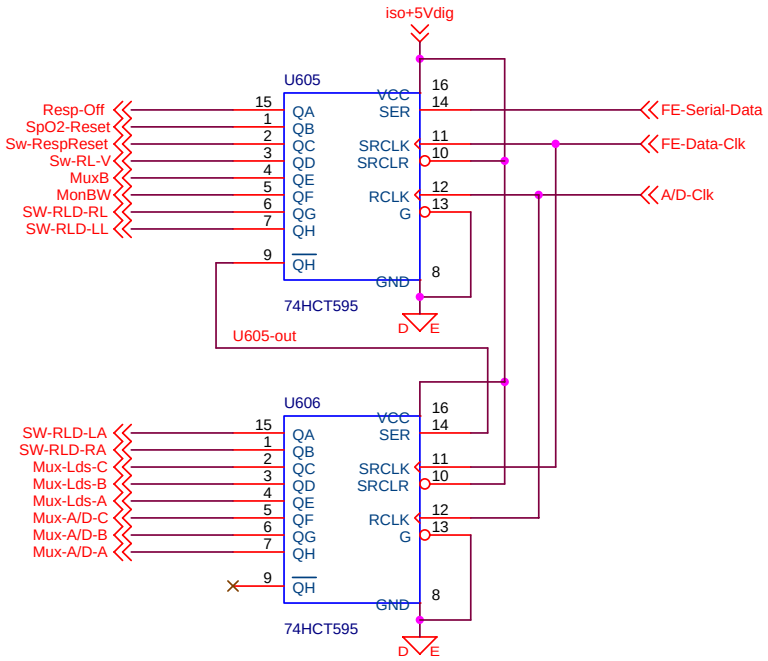


Figure A-28. Serial communication circuit.

Signal Isolation

Optocouplers are used to electrically isolate signals. The following signals are transmitted across the isolation barrier through the optocouplers:

1. SpO2 out: SpO2 serial data, waveform and status information.
   Opto U411 Data from the SpO2 board to the CPU board.
2. Serial Data: Serial Control data for isolated circuits.
   Opto U613 Data from the CPU board to isolated circuits.
3. Serial Data Clock:Data clock for serial control data.
   Opto U612 Clock from the CPU board to isolated circuits.
4. ADC Clock Clock for PWM A/D converter, also used to latch control shift registers.
   Opto U611 Clock from the CPU board to isolated circuits.
5. PWM A/D dataA/D Pulse width data.
   Opto U610 Pulse width data from isolated circuits to CPU board.
6. Respiration ClockClock for Respiration drive circuit (same signal as power supply sync)
   U710 Clock from the CPU board to isolated circuits (model 622/623 only).

ECG Circuits

Overview

Atlas provides a 5-wire front end, and will be compatible with both a 3-wire and 5-wire cable. Monitor (0.5Hz to 40Hz) Extended (0.05Hz to 100Hz) bandwidth are provided. The ECG amplifier always transmits 0.05Hz to 100Hz data to the CPU board (unless in baseline restore mode), additional filtering for Monitor Bandwidth is implemented in software.

Defib Protect, RFI Filtering

The ECG lead set includes a 1K resistor for current limiting. The neon bulbs act as a voltage clamp, limiting voltage to about 100V. Neons are chosen for their low capacitance and high DC impedance when off. Series resistors and diode clamps are used as a second set of protection circuits for the front-end amplifiers. Resistors R506, R507 and Diodes D506, D507, are used to reverse bias the lead clamp diodes (D501 to D505). Two passive RC filters are used to reduce susceptibility to RFI and ESU.

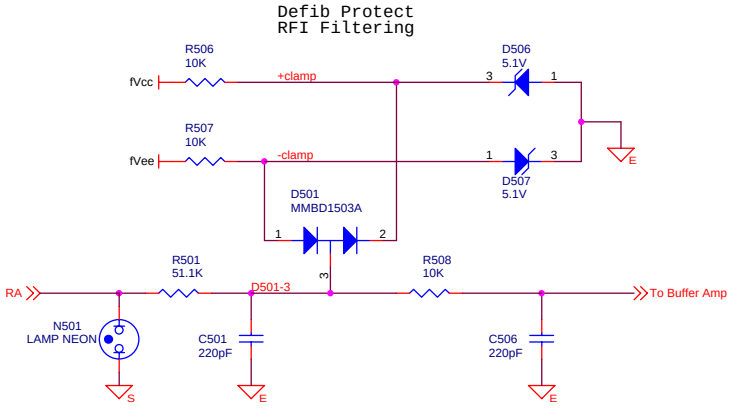


Figure A-29. Defib protect and RFI filtering circuit.

Note: *Typical protection for each lead wire. Model 621 uses a dual silicon series diode in place of zener diodes D506 and D507.*

Front End Buffer - 1st Gain Stage

Gain of the first stage is 9.26 (1+10K/1.21K). Bias current for each input buffer is set to 1.25V/44Meg = 28nA (VldsOff = 1.25V). On a leads-off condition, the two 22Meg resistor drives the input of the buffer to 1.25V (VldsOff), and the amplifier output saturates high (at about 5.5V). The voltage out of each buffer is monitored to detect a leads-off condition.

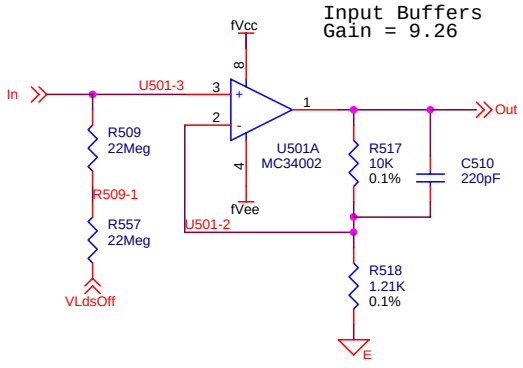


Figure A-30. Input buffer circuit.

Wilson Network - Lead Select Mux

A 5 wire front end must be able to render the following vectors:

I	LA - RA
II	LL - RA
III	LL - LA
aVR	RA - 1/2*(LA + LL)
aVL	LA - 1/2*(RA + LL)
aVF	LL - 1/2*(LA + RA)
V	V - 1/3*(RA + LA + LL)

A resistor divider network (Wilson Network) is used to create the terms above. These vectors are then switched though the two Lead Select Mux's and into the differential amplifier.

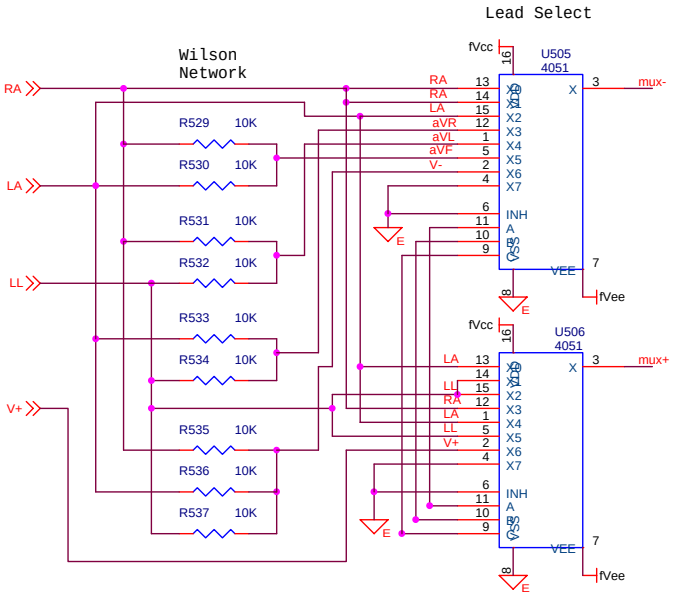


Figure A-31. Lead select circuit.

Differential Amplifier and Slew rate limit

A traditional 3-opamp gain stage (U507 and U508) is used to construct the differential amplifier. The topology is modified slightly with the addition of slew rate limiting (U509). The ECG signal is slew rate limited to about 100V/sec. This is done to minimize distortion of the ECG trace in the presence or large pace pulses. The differential outputs of this amplifier stage are used as input to the Right Leg Drive amplifier.

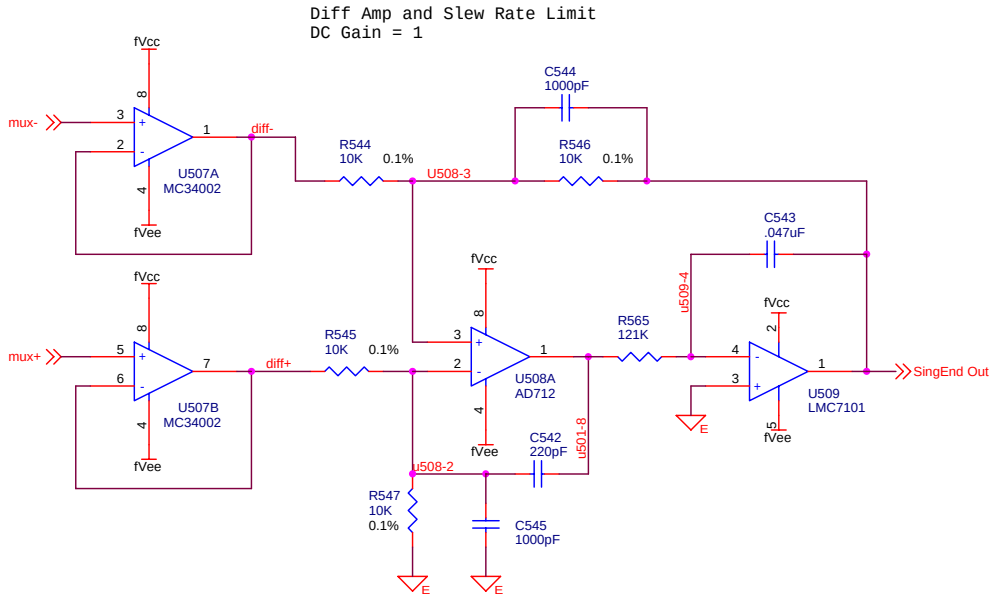


Figure A-32. Differential amp/slew rate amp circuit.

Right Leg Drive Amplifier

The right leg amplifier performs two functions. First is to provide bias current to the input buffer amplifiers. Second, to reduce 60Hz interference (increase CMR). Patient Common mode signals are amplified and inverted, and this resultant signal used to drive the patient. Gain of the RLD amplifier at 60Hz is maximized, while keeping the system gain stable. The RLD output is mux'd to the appropriate wire depending on the chosen input vector. For example, when looking at Lead I (LA-RA), the RLD signal is switched to the LL buffer.

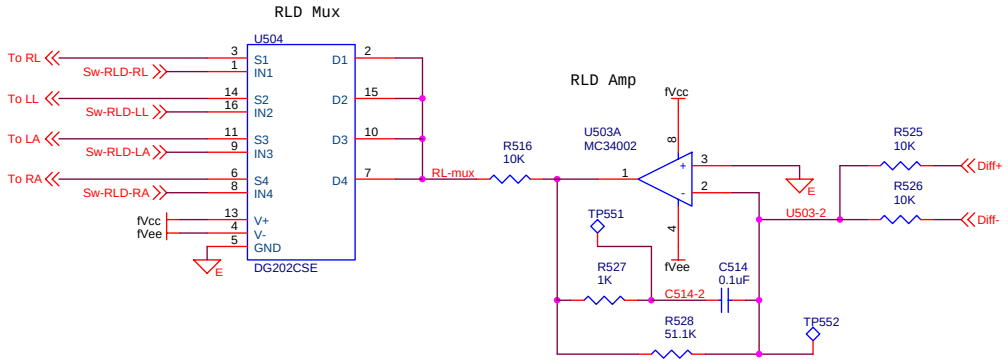


Figure A-33. Right leg drive circuit.

High Pass and Gain Stage

The signal from the output of the differential amplifier is AC coupled before a final stage of amplification. The High Pass Pole is set to 0.05Hz (a 3.3 second time constant). Large DC signals are sometimes present, for example, following a Leads Off condition. In order to quickly restore the ECG baseline, a transistor switch (Q504, Q505) is used to change the AC pole time constant to 0.33 seconds. Op Amp U508 provides the final amplification prior to the A/D converter.

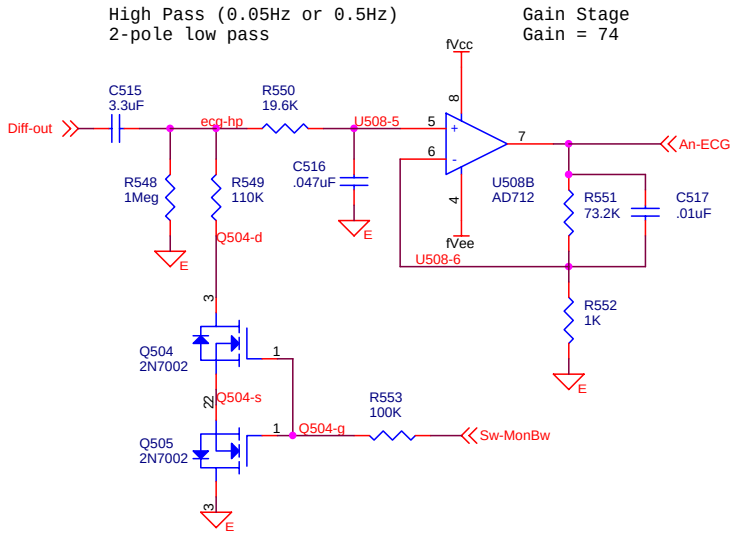


Figure A-34. High pass and gain stage circuit.

Temperature Amplifier (Model 622/623 only)

The temperature option of Atlas is designed to operate with YSI-400 series probes. This probe has a negative temperature coefficient, R@30C = 1815Ohms, R@40C = 1200Ohms. The temperature amplifier is configured as a non-inverting gain stage. The positive input to the amplifier is a 1.25V reference. The output of the temperature amplifier is V = Ref*(1+Rfb/Rthermistor).

The A/D converter will digitize the An-Temp input, along with the reference voltage and ground. The gain of the A/D is calibrated from the reference voltage measurement, and any drifts in the reference voltage or A/D gain are continuously compensated during monitoring.

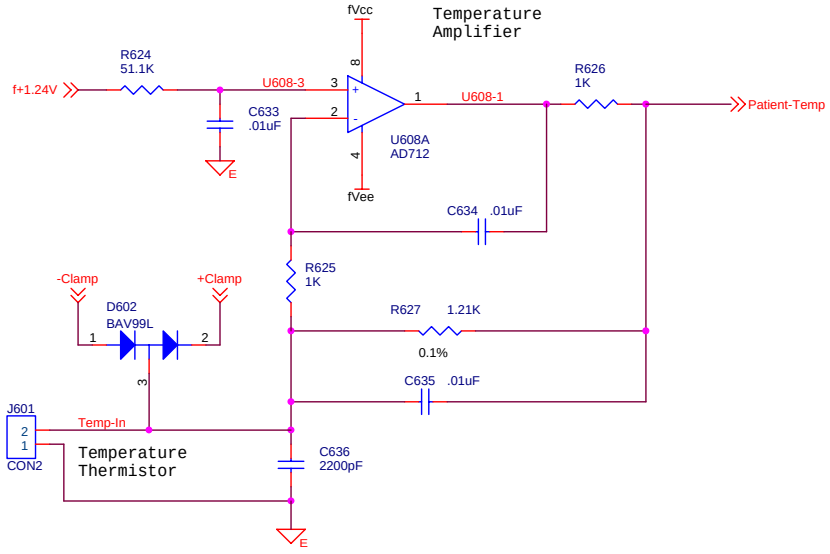


Figure A-35. Temperature amplifier circuit.

Impedance Respiration (Model 622/623 only)

Overview

Impedance respiration is accomplished by measuring a change of resistance across the patient's chest during breathing. The RA and LA electrodes (Lead I) are uses to acquire the respiration signal. A current source is driven through the patient, and the voltage developed across the patient is measured. The change in resistance caused by respiration is small, in the order of 1 Ohm. This small change must be measured on top of a large baseline impedance, typically 100 to 1000 Ohms.

Signal Source – Current Drive

An AC current source is used as the input signal, a 34.8KHz square wave. The Power supply sync signal, at 76.8KHz, is transmitted across opto isolator U710. Flip Flop U701, configured as a divide by 2, converts this signal to a 34.8KHz. Current through the patient is about 150uA Pk-Pk, set by the output of U710 (5V) and the circuit series impedance, 69K including cable resistance. The impedance of the patient is small (<2K) compared to the series impedance and has minimal affect on the magnitude of the drive current. Diode clamps are used to protect the respiration circuits in the event of a Defibrillation pulse.

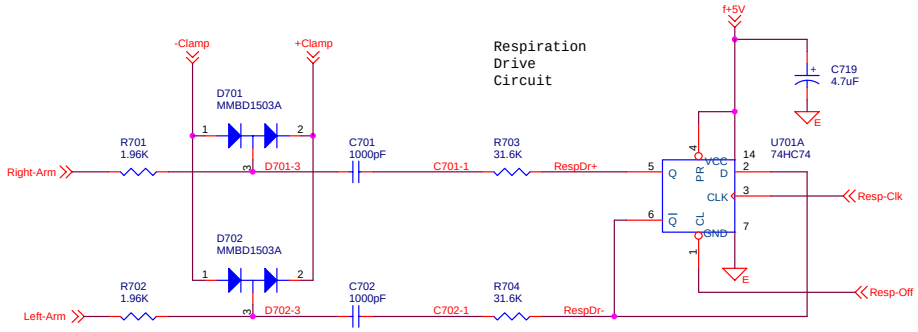


Figure A-36. Respiration drive circuit.

Differential Amplifier and Peak Detector

The AC current driven though the patient develops a voltage across the RA to LA electrodes. This signal is measured and amplified with the Differential Amplifier formed by U702A/B. This amplifier converts the differential voltage across the patient to single ended signal, with a gain of 16.8. Inverting this signal (U703A), and summing the original signal and inverted signal through the dual Diode D705 then forms a synchronous peak detector. Then, the voltage on C711 is the DC resistance seen across the RA to LA buffer. This baseline resistance is digitized, and if the signal is too large (>2.5K), a Respiration Lead Fault message is displayed. Note that this circuit measurement includes the two 1K resistors in the EKG cable set. This 2K resistance is subtracted in software before determining a leads off condition.

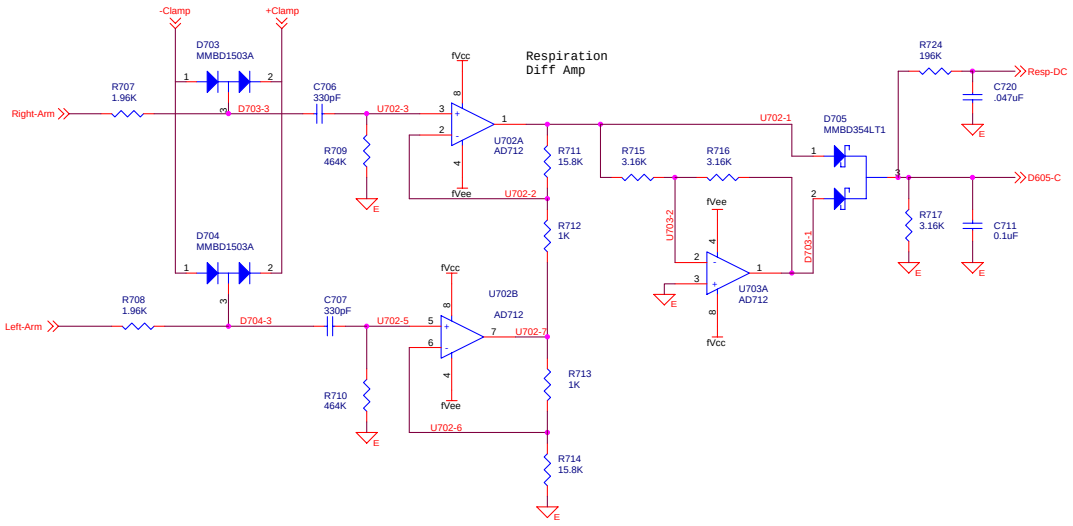


Figure A-37. Respiration diff amp circuit.

Gain and Filtering

The DC content (baseline resistance) of the respiration signal is not needed, so the signal is next AC coupled, and additional gain applied before digitization. Low pass filtering is performed at this stage to reduce high frequency noise outside the respiration signal bandwidth. A baseline-reset circuit (transistor switch Q701) is used to quickly restore the high pass pole if excessive DC voltage is present, for example following a Leads-Off condition.

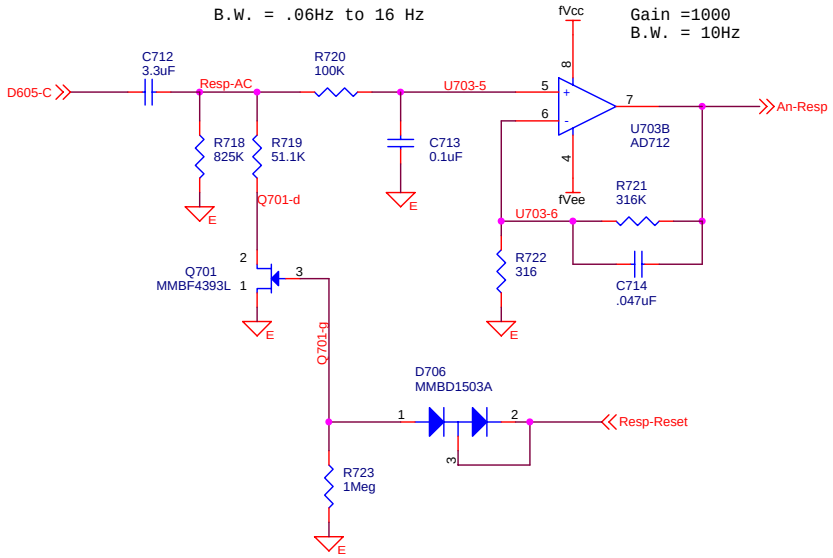


Figure A-38. Gain and filter circuit.

SpO2 Circuits

The SpO2 transducer senses oxygen content of functional arteriolar hemoglobin through the use of light (red and infrared) passed through the sensor. The reflective characteristics of hemoglobin at the wavelengths used allow the pulse oximetry circuits to obtain changing saturation levels. This data is then processed to obtain the oxygen saturation percentage and pulse rate.

Nellcor or Nonin Medical provides the SpO2 board (Nonin only for the model 621). The SpO2 board includes amplifiers and processing, and transmits serial data to the CPU board (Waveform data, SpO2%, and pulse rate). The Atlas monitor provides electrical isolation (power and data) to the SpO2 board. Note that you must use Nonin probes with the Nonin SpO2 board, and Nellcor probes with Nellcor SpO2 board.

Table B-1. Atlas 621N0 repair parts.

Part#	Description
620001-503	MAIN PCB ASSY - LOW END
620004-502	ATLAS CPU PCB ASSY
620007-501	FRONT PANEL DISPLAY PCB ASSY.
620038	NELLCOR LABEL (CARTON)
6200-43E	SERVICE MANUAL (ATLAS)
620089	BATTERY, 3V LITHIUM
620105-3	BATTERY DOOR
620119	LATCH SPO2
620125-502	MAIN CASE/HANDLE SET W/PANEL
620126-4	BEZEL SET - HEAT TRANSFER
620131-1	MAIN FOAM
620132-2	TOP FOAM
620133	BP FOAM
620141	METAL HOUSING - TOP
620142-1	METAL HOUSING-BOTTOM (LG)
620144	BRACKET SPO2
620150-1	AC/DC POWER SUPPLY
620156	PUMP
620157	STEPPER VALVE
620158	CHECK VALVE
620163	CABLE ASSY -PUMP/PNEUMATIC VLV
620165	CABLE-CONN TO MAIN BD,ECG
620167	CABLE-MAIN BD TO DISPLAY BD
620168-2	CABLE ASSY POWER SUPPLY
620170	CABLE ASSY NELLCOR
620171	CABLE ASSY SPEAKER
620172-2	CABLE ASSY AC
620178	CABLE ASSY SP02
620181-1	LABEL,BOTTOM,LOW END
620187-501	PNEUMATIC SUB ASSY
620189	4-20 X 5/16 SLT/TORX PN PL ZIN
620192-1	PNEUMATIC CONNECTOR
620193	NUT, HEX 5/16-32 X.095 PNEUM

Table B-1. Atlas 621N0 repair parts.

Part#	Description
620194	WASHER,FLT.33 X.62 X.049 PNEUM
620197	BUSHING, SPLIT NYLON
620198	FOOT
620200-501	CRT SUB ASY
620205	4-40 X .31 TX PN MC ST ZN
620214-1	TUBING, SILICONE, 1/16 .50
620215-1	TUBING, SILICONE 1/8 X1.00
620215-2	TUBING, SILICONE 1/8 X 2.125
620215-3	TUBING, SILICONE 1/8 X 7.50
620215-4	TUBING, SILICONE 1/8 X.750
620216	FITTING ““Y”” 1/8 X 1/8 X 1/8
620217	FITTING, ““T””, 1/8 X 1/16X 1/8
620377-1	NELLCOR WORKS HERE” LABEL
620377-2	NELLCOR PATENT LABEL
620378-1	ATLAS KEYPAD(BP START/CANCEL)
620378-2	ATLAS KEYPAD(TREND/LEAD/PRINT)
620378-3	ATLAS KEYPAD(SP02/CLOCK/POWER)
620378-4	ATLAS KEYPAD(4 ALARMS)
620378-5	ATLAS KEYPAD(SILENCE ALARM)
620378-6	ATLAS KEYPAD(SILENCE BELL)
620379-501	MONITOR BOX W/INSERTS
620384-2C	LOW LABEL W/FREEZE (CHINESE)
620384-2E	DISPLAY LABEL-LOW/FREEZE/ENG
620384-2F	DISPLAY LABEL-LOW/FREEZE/FR.
620384-2G	LOW LABEL W/FREEZE (GERMAN)
620384-2I	LOW LABEL W/PRINTER (ITALIAN)
620384-2J	LOW LABEL W/FREEZE (JAPANESE)
620384-2P	LOW LABEL W/FREEZE (PORT)
620384-2S	LOW LABEL W/FREEZE (SPANISH)
620385	SUB-LABEL DISPLAY
620386	FASTON TAB
620388-2	LABEL, NELLCOR SENSOR
620393	PWR SUPPLY INSULATOR LABEL
620394-1	“WASHER, SHOULDER PLATED

Table B-1. Atlas 621N0 repair parts.

Part#	Description
620403	FLAT TIE HOLDER
620432	ATLAS MONITOR CALIBRATION CERT
620494-501	ATLAS FAN KIT
620530	D CONN.LOCATOR\NELLCOR MP506
620531	CABLE ASSY,NELLCOR MP506 SEN.
620532	NELLCOR MP506 SPO2 PCB
761077-1	WIRE TIE

Table B-2. Atlas 621NP repair parts.

Part#	Description
620001-503	MAIN PCB ASSY - LOW END
620004-502	ATLAS CPU PCB ASSY
620007-501	FRONT PANEL DISPLAY PCB ASSY.
620013-502	PRINTER PCB
620038	NELLCOR LABEL (CARTON)
6200-43E	SERVICE MANUAL (ATLAS)
620089	BATTERY, 3V LITHIUM
620105-3	BATTERY DOOR
620117	PRINTER DOOR BUTTON
620119	LATCH SPO2
620125-501	MAIN CASE/HANDLE SET
620126-4	BEZEL SET - HEAT TRANSFER
620131-1	MAIN FOAM
620132-2	TOP FOAM
620133	BP FOAM
620134-501	GEAR ASSY
620138-501	PRINTER DOOR ASSY
620139-501	PRINTER FRAME ASSE
620140-501	MAIN PRINTER ASSY
620140-502	PRINTER ASSY W/STATIC BAG
620141	METAL HOUSING - TOP
620142-1	METAL HOUSING-BOTTOM (LG)
620144	BRACKET SPO2
620150-1	AC/DC POWER SUPPLY
620156	PUMP
620157	STEPPER VALVE
620158	CHECK VALVE
620163	CABLE ASSY -PUMP/PNEUMATIC VLV
620165	CABLE-CONN TO MAIN BD,ECG
620167	CABLE-MAIN BD TO DISPLAY BD
620168-2	CABLE ASSY POWER SUPPLY
620170	CABLE ASSY NELLCOR
620171	CABLE ASSY SPEAKER

Table B-2. Atlas 621NP repair parts.

Part#	Description
620172-2	CABLE ASSY AC
620176	CABLE ASSY - PRINTER
620177	CABLE ASSY - PRINT HEAD
620178	CABLE ASSY SP02
620181-1	LABEL,BOTTOM,LOW END
620187-501	PNEUMATIC SUB ASSY
620189	4-20 X 5/16 SLT/TORX PN PL ZIN
620192-1	PNEUMATIC CONNECTOR
620193	NUT, HEX 5/16-32 X.095 PNEUM
620194	WASHER,FLT.33 X.62 X.049 PNEUM
620197	BUSHING, SPLIT NYLON
620198	FOOT
620200-501	CRT SUB ASY
620205	4-40 X .31 TX PN MC ST ZN
620207	NUT, M3-.5 HEX KEPS ST ZN
620214-1	TUBING, SILICONE, 1/16 .50
620215-1	TUBING, SILICONE 1/8 X1.00
620215-2	TUBING, SILICONE 1/8 X 2.125
620215-3	TUBING, SILICONE 1/8 X 7.50
620215-4	TUBING, SILICONE 1/8 X.750
620216	FITTING ““Y”” 1/8 X 1/8 X 1/8
620217	FITTING, ““T””, 1/8 X 1/16X 1/8
620377-1	NELLCOR WORKS HERE LABEL
620377-2	NELLCOR PATENT LABEL
620378-1	ATLAS KEYPAD(BP START/CANCEL)
620378-2	ATLAS KEYPAD(TREND/LEAD/PRINT)
620378-3	ATLAS KEYPAD(SP02/CLOCK/POWER)
620378-4	ATLAS KEYPAD(4 ALARMS)
620378-5	ATLAS KEYPAD(SILENCE ALARM)
620378-6	ATLAS KEYPAD(SILENCE BELL)
620379-501	MONITOR BOX W/INSERTS
620384-1C	LOW LABEL W/PRINTER (CHINESE)
620384-1E	DISPLAY LABEL/LOW/PRINTER-ENG
620384-1F	LOW LABEL W/PRINTER (FRENCH)

Table B-2. Atlas 621NP repair parts.

Part#	Description
620384-1G	LOW LABEL W/PRINTER (GERMAN)
620384-1I	LOW LABEL W/PRINTER (ITALIAN)
620384-1J	LOW LABEL W/PRINTER (JAPANESE)
620384-1P	LOW LABEL W/PRINTER (PORT)
620384-1S	LOW LABEL W/PRINTER (SPANISH)
620385	SUB-LABEL DISPLAY
620386	FASTON TAB
620388-2	LABEL, NELLCOR SENSOR
620393	PWR SUPPLY INSULATOR LABEL
620394-1	WASHER, SHOULDER PLATED
620403	FLAT TIE HOLDER
620494-501	ATLAS FAN KIT
620530	D CONN.LOCATOR\NELLCOR MP506
620531	CABLE ASSY,NELLCOR MP506 Sen.
620532	NELLCOR MP506 SPO2 PCB
761077-1	WIRE TIE

Table B-3. Atlas 621S0 repair parts.

Part#	Description
620001-503	MAIN PCB ASSY - LOW END
620004-502	ATLAS CPU PCB ASSY
620007-501	FRONT PANEL DISPLAY PCB ASSY.
6200-43E	SERVICE MANUAL (ATLAS)
620089	BATTERY, 3V LITHIUM
620105-3	BATTERY DOOR
620119	LATCH SPO2
620125-502	MAIN CASE/HANDLE SET W/PANEL
620126-4	BEZEL SET - HEAT TRANSFER
620131-1	MAIN FOAM
620132-2	TOP FOAM
620133	BP FOAM
620141	METAL HOUSING - TOP
620142-1	METAL HOUSING-BOTTOM (LG)
620144	BRACKET SPO2
620150-1	AC/DC POWER SUPPLY
620156	PUMP
620157	STEPPER VALVE
620158	CHECK VALVE
620163	CABLE ASSY -PUMP/PNEUMATIC VLV
620165	CABLE-CONN TO MAIN BD,ECG
620167	CABLE-MAIN BD TO DISPLAY BD
620168-2	CABLE ASSY POWER SUPPLY
620171	CABLE ASSY SPEAKER
620172-2	CABLE ASSY AC
620181-1	LABEL,BOTTOM,LOW END
620187-501	PNEUMATIC SUB ASSY
620189	4-20 X 5/16 SLT/TORX PN PL ZIN
620192-1	PNEUMATIC CONNECTOR
620193	NUT, HEX 5/16-32 X.095 PNEUM
620194	WASHER,FLT.33 X.62 X.049 PNEUM
620197	BUSHING, SPLIT NYLON
620198	FOOT

Table B-3. Atlas 621S0 repair parts.

Part#	Description
620200-501	CRT SUB ASY
620205	4-40 X .31 TX PN MC ST ZN
620214-1	TUBING, SILICONE, 1/16 .50
620215-1	TUBING, SILICONE 1/8 X1.00
620215-2	TUBING, SILICONE 1/8 X 2.125
620215-3	TUBING, SILICONE 1/8 X 7.50
620215-4	TUBING, SILICONE 1/8 X.750
620216	FITTING ““Y”” 1/8 X 1/8 X 1/8
620217	FITTING, ““T””, 1/8 X 1/16X 1/8
620373-501	NONIN SUB ASSEMBLY
620378-1	ATLAS KEYPAD(BP START/CANCEL)
620378-2	ATLAS KEYPAD(TREND/LEAD/PRINT)
620378-3	ATLAS KEYPAD(SP02/CLOCK/POWER)
620378-4	ATLAS KEYPAD(4 ALARMS)
620378-5	ATLAS KEYPAD(SILENCE ALARM)
620378-6	ATLAS KEYPAD(SILENCE BELL)
620379-501	MONITOR BOX W/INSERTS
620384-2C	LOW LABEL W/FREEZE (CHINESE)
620384-2E	DISPLAY LABEL-LOW/FREEZE/ENG
620384-2F	DISPLAY LABEL-LOW/FREEZE/FR.
620384-2G	LOW LABEL W/FREEZE (GERMAN)
620384-2I	LOW LABEL W/PRINTER (ITALIAN)
620384-2J	LOW LABEL W/FREEZE (JAPANESE)
620384-2P	LOW LABEL W/FREEZE (PORT)
620384-2S	LOW LABEL W/FREEZE (SPANISH)
620385	SUB-LABEL DISPLAY
620386	FASTON TAB
620388-1	LABEL, NONIN SENSOR
620393	PWR SUPPLY INSULATOR LABEL
620394-1	WASHER, SHOULDER PLATED
620403	FLAT TIE HOLDER
620494-501	ATLAS FAN KIT
761077-1	WIRE TIE

Table B-4. Atlas 621SP repair parts.

Part#	Description
620001-503	MAIN PCB ASSY - LOW END
620004-502	ATLAS CPU PCB ASSY
620007-501	FRONT PANEL DISPLAY PCB ASSY.
620013-502	PRINTER PCB
6200-43E	SERVICE MANUAL (ATLAS)
620089	BATTERY, 3V LITHIUM
620105-3	BATTERY DOOR
620117	PRINTER DOOR BUTTON
620119	LATCH SPO2
620125-501	MAIN CASE/HANDLE SET
620126-4	BEZEL SET - HEAT TRANSFER
620131-1	MAIN FOAM
620132-2	TOP FOAM
620133	BP FOAM
620134-501	GEAR ASSY
620138-501	PRINTER DOOR ASSY
620139-501	PRINTER FRAME ASSE
620140-501	MAIN PRINTER ASSY
620140-502	PRINTER ASSY W/STATIC BAG
620141	METAL HOUSING - TOP
620142-1	METAL HOUSING-BOTTOM (LG)
620144	BRACKET SPO2
620150-1	AC/DC POWER SUPPLY
620156	PUMP
620157	STEPPER VALVE
620158	CHECK VALVE
620163	CABLE ASSY -PUMP/PNEUMATIC VLV
620165	CABLE-CONN TO MAIN BD,ECG
620167	CABLE-MAIN BD TO DISPLAY BD
620168-2	CABLE ASSY POWER SUPPLY
620171	CABLE ASSY SPEAKER
620172-2	CABLE ASSY AC
620176	CABLE ASSY - PRINTER

Table B-4. Atlas 621SP repair parts.

Part#	Description
620177	CABLE ASSY - PRINT HEAD
620181-1	LABEL,BOTTOM,LOW END
620187-501	PNEUMATIC SUB ASSY
620189	4-20 X 5/16 SLT/TORX PN PL ZIN
620192-1	PNEUMATIC CONNECTOR
620193	NUT, HEX 5/16-32 X.095 PNEUM
620194	WASHER,FLT.33 X.62 X.049 PNEUM
620197	BUSHING, SPLIT NYLON
620198	FOOT
620200-501	CRT SUB ASY
620205	4-40 X .31 TX PN MC ST ZN
620207	NUT, M3-.5 HEX KEPS ST ZN
620214-1	TUBING, SILICONE, 1/16 .50
620215-1	TUBING, SILICONE 1/8 X1.00
620215-2	TUBING, SILICONE 1/8 X 2.125
620215-3	TUBING, SILICONE 1/8 X 7.50
620215-4	TUBING, SILICONE 1/8 X.750
620216	FITTING “Y” 1/8 X 1/8 X 1/8
620217	FITTING, “T”, 1/8 X 1/16X 1/8
620373-501	NONIN SUB ASSEMBLY
620378-1	ATLAS KEYPAD(BP START/CANCEL)
620378-2	ATLAS KEYPAD(TREND/LEAD/PRINT)
620378-3	ATLAS KEYPAD(SP02/CLOCK/POWER)
620378-4	ATLAS KEYPAD(4 ALARMS)
620378-5	ATLAS KEYPAD(SILENCE ALARM)
620378-6	ATLAS KEYPAD(SILENCE BELL)
620379-501	MONITOR BOX W/INSERTS
620384-1C	LOW LABEL W/PRINTER (CHINESE)
620384-1E	DISPLAY LABEL/LOW/PRINTER-ENG
620384-1F	LOW LABEL W/PRINTER (FRENCH)
620384-1G	LOW LABEL W/PRINTER (GERMAN)
620384-1I	LOW LABEL W/PRINTER (ITALIAN)
620384-1J	LOW LABEL W/PRINTER (JAPANESE)
620384-1P	LOW LABEL W/PRINTER (PORT)

Table B-4. Atlas 621SP repair parts.

Part#	Description
620384-1S	LOW LABEL W/PRINTER (SPANISH)
620385	SUB-LABEL DISPLAY
620386	FASTON TAB
620388-1	LABEL, NONIN SENSOR
620393	PWR SUPPLY INSULATOR LABEL
620394-1	WASHER, SHOULDER PLATED
620403	FLAT TIE HOLDER
620494-501	ATLAS FAN KIT
761077-1	WIRE TIE

Table B-5. Atlas 622N0 repair parts.

Part#	Description
620004-502	ATLAS CPU PCB ASSY
620007-501	FRONT PANEL DISPLAY PCB ASSY.
620016-503	MAIN PCB ASSY-MID/HIGH END
620038	NELLCOR LABEL (CARTON)
6200-43E	SERVICE MANUAL (ATLAS)
620105-1	BATTERY DOOR
620105-3	BATTERY DOOR
620119	LATCH SPO2
620125-502	MAIN CASE/HANDLE SET W/PANEL
620126-5	BEZEL SET/MID PRINTED
620131-1	MAIN FOAM
620132-2	TOP FOAM
620133	BP FOAM
620141	METAL HOUSING - TOP
620142-1	METAL HOUSING-BOTTOM (LG)
620143	NUT TEMPERATURE
620144	BRACKET SPO2
620150-1	AC/DC POWER SUPPLY
620156	PUMP
620157	STEPPER VALVE
620158	CHECK VALVE
620163	CABLE ASSY -PUMP/PNEUMATIC VLV
620165	CABLE-CONN TO MAIN BD,ECG
620167	CABLE-MAIN BD TO DISPLAY BD
620168-2	CABLE ASSY POWER SUPPLY
620170	CABLE ASSY NELLCOR
620171	CABLE ASSY SPEAKER
620172-2	CABLE ASSY AC
620173	CABLE-TEMP SENSOR TO MAIN BD
620175	CABLE ASSY - FAN
620178	CABLE ASSY SP02
620181-2	LABEL,BOTTOM,MID END
620182	LABEL - RS232

Table B-5. Atlas 622N0 repair parts.

Part#	Description
620187-501	PNEUMATIC SUB ASSY
620189	4-20 X 5/16 SLT/TORX PN PL ZIN
620192-1	PNEUMATIC CONNECTOR
620193	NUT, HEX 5/16-32 X.095 PNEUM
620194	WASHER,FLT.33 X.62 X.049 PNEUM
620197	BUSHING, SPLIT NYLON
620198	FOOT
620200-501	CRT SUB ASY
620205	4-40 X .31 TX PN MC ST ZN
620214-1	TUBING, SILICONE, 1/16 .50
620215-1	TUBING, SILICONE 1/8 X1.00
620215-2	TUBING, SILICONE 1/8 X 2.125
620215-3	TUBING, SILICONE 1/8 X 7.50
620215-4	TUBING, SILICONE 1/8 X.750
620216	FITTING “Y” 1/8 X 1/8 X 1/8
620217	FITTING, “T”, 1/8 X 1/16X 1/8
620377-1	NELLCOR WORKS HERE LABEL
620377-2	NELLCOR PATENT LABEL
620378-1	ATLAS KEYPAD(BP START/CANCEL)
620378-2	ATLAS KEYPAD(TREND/LEAD/PRINT)
620378-3	ATLAS KEYPAD(SP02/CLOCK/POWER)
620378-4	ATLAS KEYPAD(4 ALARMS)
620378-5	ATLAS KEYPAD(SILENCE ALARM)
620378-6	ATLAS KEYPAD(SILENCE BELL)
620379-501	MONITOR BOX W/INSERTS
620384-4C	MID LABEL W/FREEZE (CHINESE)
620384-4E	DISPLAY LABEL-MID/FREEZE/ENG
620384-4F	MID LABEL W/FREEZE (FRENCH)
620384-4G	MID LABEL W/FREEZE (GERMAN)
620384-4I	LOW LABEL W/FREEZE (ITALIAN)
620384-4J	LOW LABEL W/FREEZE (JAPANESE)
620384-4P	LOW LABEL W/FREEZE (PORT)
620384-4S	LOW LABEL W/FREEZE (SPANISH)
620385	SUB-LABEL DISPLAY

Table B-5. Atlas 622N0 repair parts.

Part#	Description
620386	FASTON TAB
620388-2	LABEL, NELLCOR SENSOR
620393	PWR SUPPLY INSULATOR LABEL
620394-1	WASHER, SHOULDER PLATED
620395-501	REPLACEMENT BATTERY SUB ASSY
620403	FLAT TIE HOLDER
620530	D CONN.LOCATOR\NELLCOR MP506
620531	CABLE ASSY,NELLCOR MP506 SEN.
620532	NELLCOR MP506 SPO2 PCB
761077-1	WIRE TIE

Table B-6. Atlas 622NP repair parts.

Part#	Description
620004-502	ATLAS CPU PCB ASSY
620007-501	FRONT PANEL DISPLAY PCB ASSY.
620013-502	PRINTER PCB
620016-503	MAIN PCB ASSY-MID/HIGH END
620038	NELLCOR LABEL (CARTON)
6200-43E	SERVICE MANUAL (ATLAS)
620105-3	BATTERY DOOR
620117	PRINTER DOOR BUTTON
620119	LATCH SPO2
620125-501	MAIN CASE/HANDLE SET
620126-5	BEZEL SET/MID PRINTED
620131-1	MAIN FOAM
620132-2	TOP FOAM
620133	BP FOAM
620134-501	GEAR ASSY
620138-501	PRINTER DOOR ASSY
620139-501	PRINTER FRAME ASSE
620140-501	MAIN PRINTER ASSY
620140-502	PRINTER ASSY W/STATIC BAG
620141	METAL HOUSING - TOP
620142-1	METAL HOUSING-BOTTOM (LG)
620143	NUT TEMPERATURE
620144	BRACKET SPO2
620150-1	AC/DC POWER SUPPLY
620156	PUMP
620157	STEPPER VALVE
620158	CHECK VALVE
620163	CABLE ASSY -PUMP/PNEUMATIC VLV
620165	CABLE-CONN TO MAIN BD,ECG
620167	CABLE-MAIN BD TO DISPLAY BD
620168-2	CABLE ASSY POWER SUPPLY
620170	CABLE ASSY NELLCOR
620171	CABLE ASSY SPEAKER

Table B-6. Atlas 622NP repair parts.

Part#	Description
620172-2	CABLE ASSY AC
620173	CABLE-TEMP SENSOR TO MAIN BD
620175	CABLE ASSY - FAN
620176	CABLE ASSY - PRINTER
620177	CABLE ASSY - PRINT HEAD
620178	CABLE ASSY SP02
620181-2	“LABEL,BOTTOM,MID END “
620182	LABEL - RS232
620187-501	PNEUMATIC SUB ASSY
620189	4-20 X 5/16 SLT/TORX PN PL ZIN
620192-1	PNEUMATIC CONNECTOR
620193	NUT, HEX 5/16-32 X.095 PNEUM
620194	WASHER,FLT.33 X.62 X.049 PNEUM
620197	BUSHING, SPLIT NYLON
620198	FOOT
620200-501	CRT SUB ASY
620205	4-40 X .31 TX PN MC ST ZN
620207	NUT, M3-.5 HEX KEPS ST ZN
620214-1	TUBING, SILICONE, 1/16 .50
620215-1	TUBING, SILICONE 1/8 X1.00
620215-2	TUBING, SILICONE 1/8 X 2.125
620215-3	TUBING, SILICONE 1/8 X 7.50
620215-4	TUBING, SILICONE 1/8 X.750
620216	FITTING ““Y”” 1/8 X 1/8 X 1/8
620217	FITTING, ““T””, 1/8 X 1/16X 1/8
620377-1	NELLCOR WORKS HERE”” LABEL
620377-2	NELLCOR PATENT LABEL
620378-1	ATLAS KEYPAD(BP START/CANCEL)
620378-2	ATLAS KEYPAD(TREND/LEAD/PRINT)
620378-3	ATLAS KEYPAD(SP02/CLOCK/POWER)
620378-4	ATLAS KEYPAD(4 ALARMS)
620378-5	ATLAS KEYPAD(SILENCE ALARM)
620378-6	ATLAS KEYPAD(SILENCE BELL)
620379-501	MONITOR BOX W/INSERTS

Table B-6. Atlas 622NP repair parts.

Part#	Description
620384-3C	MID LABEL W/PRINTER(CHINESE)
620384-3E	DISPLAY LABEL-MID/PRINTER/ENG
620384-3F	MID LABEL W/PRINTER (FRENCH)
620384-3G	MID LABEL W/PRINTER (GERMAN)
620384-3I	MID LABEL W/PRINTER (ITALIAN)
620384-3J	MID LABEL W/PRINTER (JAPANESE)
620384-3P	MID LABEL W/PRINTER (PORT)
620384-3S	LOW LABEL W/PRINTER (SPANISH)
620385	SUB-LABEL DISPLAY
620386	FASTON TAB
620388-2	LABEL, NELLCOR SENSOR
620393	PWR SUPPLY INSULATOR LABEL
620394-1	WASHER, SHOULDER PLATED
620395-501	REPLACEMENT BATTERY SUB ASSY
620403	FLAT TIE HOLDER
620530	D CONN.LOCATOR\NELLCOR MP506
620531	CABLE ASSY,NELLCOR MP506 SEN.
620532	NELLCOR MP506 SPO2 PCB
761077-1	WIRE TIE

Table B-7. Atlas 622S0 repair parts.

Part#	Description
620004-502	ATLAS CPU PCB ASSY
620007-501	FRONT PANEL DISPLAY PCB ASSY.
620016-503	MAIN PCB ASSY-MID/HIGH END
6200-43E	SERVICE MANUAL (ATLAS)
620105-3	BATTERY DOOR
620119	LATCH SPO2
620125-502	MAIN CASE/HANDLE SET W/PANEL
620126-5	BEZEL SET/MID PRINTED
620131-1	MAIN FOAM
620132-2	TOP FOAM
620133	BP FOAM
620141	METAL HOUSING - TOP
620142-1	METAL HOUSING-BOTTOM (LG)
620143	NUT TEMPERATURE
620144	BRACKET SPO2
620150-1	AC/DC POWER SUPPLY
620156	PUMP
620157	STEPPER VALVE
620158	CHECK VALVE
620163	CABLE ASSY -PUMP/PNEUMATIC VLV
620165	CABLE-CONN TO MAIN BD,ECG
620167	CABLE-MAIN BD TO DISPLAY BD
620168-2	CABLE ASSY POWER SUPPLY
620171	CABLE ASSY SPEAKER
620172-2	CABLE ASSY AC
620173	CABLE-TEMP SENSOR TO MAIN BD
620175	CABLE ASSY - FAN
620181-2	LABEL,BOTTOM,MID END
620182	LABEL - RS232
620187-501	PNEUMATIC SUB ASSY
620189	4-20 X 5/16 SLT/TORX PN PL ZIN
620192-1	PNEUMATIC CONNECTOR
620193	NUT, HEX 5/16-32 X.095 PNEUM

Table B-7. Atlas 622S0 repair parts.

Part#	Description
620194	WASHER,FLT.33 X.62 X.049 PNEUM
620197	BUSHING, SPLIT NYLON
620198	FOOT
620200-501	CRT SUB ASY
620205	4-40 X .31 TX PN MC ST ZN
620214-1	TUBING, SILICONE, 1/16.50
620215-1	TUBING, SILICONE 1/8 X1.00
620215-2	TUBING, SILICONE 1/8 X 2.125
620215-3	TUBING, SILICONE 1/8 X 7.50
620215-4	TUBING, SILICONE 1/8 X.750
620216	FITTING “Y” 1/8 X 1/8 X 1/8
620217	FITTING, “T”, 1/8 X 1/16X 1/8
620373-501	NONIN SUB ASSEMBLY
620378-1	ATLAS KEYPAD(BP START/CANCEL)
620378-2	ATLAS KEYPAD(TREND/LEAD/PRINT)
620378-3	ATLAS KEYPAD(SP02/CLOCK/POWER)
620378-4	ATLAS KEYPAD(4 ALARMS)
620378-5	ATLAS KEYPAD(SILENCE ALARM)
620378-6	ATLAS KEYPAD(SILENCE BELL)
620379-501	MONITOR BOX W/INSERTS
620384-4C	MID LABEL W/FREEZE (CHINESE)
620384-4E	DISPLAY LABEL-MID/FREEZE/ENG
620384-4F	MID LABEL W/FREEZE (FRENCH)
620384-4G	MID LABEL W/FREEZE (GERMAN)
620384-4I	LOW LABEL W/FREEZE (ITALIAN)
620384-4J	LOW LABEL W/FREEZE (JAPANESE)
620384-4P	LOW LABEL W/FREEZE (PORT)
620384-4S	LOW LABEL W/FREEZE (SPANISH)
620385	SUB-LABEL DISPLAY
620386	FASTON TAB
620388-1	LABEL, NONIN SENSOR
620393	PWR SUPPLY INSULATOR LABEL
620394-1	WASHER, SHOULDER PLATED
620395-501	REPLACEMENT BATTERY SUB ASSY

Table B-7. Atlas 622S0 repair parts.

Part#	Description
620403	FLAT TIE HOLDER
761077-1	WIRE TIE

Table B-8. Atlas 622SP repair parts.

Part#	Description
620004-502	ATLAS CPU PCB ASSY
620007-501	FRONT PANEL DISPLAY PCB ASSY.
620013-502	PRINTER PCB
620016-503	MAIN PCB ASSY-MID/HIGH END
6200-43E	SERVICE MANUAL (ATLAS)
620105-3	BATTERY DOOR
620117	PRINTER DOOR BUTTON
620119	LATCH SPO2
620125-501	MAIN CASE/HANDLE SET
620126-5	BEZEL SET/MID PRINTED
620131-1	MAIN FOAM
620132-2	TOP FOAM
620133	BP FOAM
620134-501	GEAR ASSY
620138-501	PRINTER DOOR ASSY
620139-501	PRINTER FRAME ASSE
620140-501	MAIN PRINTER ASSY
620140-502	PRINTER ASSY W/STATIC BAG
620141	METAL HOUSING - TOP
620142-1	METAL HOUSING-BOTTOM (LG)
620143	NUT TEMPERATURE
620144	BRACKET SPO2
620150-1	AC/DC POWER SUPPLY
620156	PUMP
620157	STEPPER VALVE
620158	CHECK VALVE
620163	CABLE ASSY -PUMP/PNEUMATIC VLV
620165	CABLE-CONN TO MAIN BD,ECG
620167	CABLE-MAIN BD TO DISPLAY BD
620168-2	CABLE ASSY POWER SUPPLY
620171	CABLE ASSY SPEAKER
620172-2	CABLE ASSY AC
620173	CABLE-TEMP SENSOR TO MAIN BD

Table B-8. Atlas 622SP repair parts.

Part#	Description
620175	CABLE ASSY - FAN
620176	CABLE ASSY - PRINTER
620177	CABLE ASSY - PRINT HEAD
620181-2	LABEL,BOTTOM,MID END
620182	LABEL - RS232
620187-501	PNEUMATIC SUB ASSY
620189	4-20 X 5/16 SLT/TORX PN PL ZIN
620192-1	PNEUMATIC CONNECTOR
620193	NUT, HEX 5/16-32 X.095 PNEUM
620194	WASHER,FLT.33 X.62 X.049 PNEUM
620197	BUSHING, SPLIT NYLON
620198	FOOT
620200-501	CRT SUB ASY
620205	4-40 X .31 TX PN MC ST ZN
620207	NUT, M3-.5 HEX KEPS ST ZN
620214-1	TUBING, SILICONE, 1/16 .50
620215-1	TUBING, SILICONE 1/8 X1.00
620215-2	TUBING, SILICONE 1/8 X 2.125
620215-3	TUBING, SILICONE 1/8 X 7.50
620215-4	TUBING, SILICONE 1/8 X.750
620216	FITTING ““Y”” 1/8 X 1/8 X 1/8
620217	FITTING, ““T””, 1/8 X 1/16X 1/8
620373-501	NONIN SUB ASSEMBLY
620378-1	ATLAS KEYPAD(BP START/CANCEL)
620378-2	ATLAS KEYPAD(TREND/LEAD/PRINT)
620378-3	ATLAS KEYPAD(SP02/CLOCK/POWER)
620378-4	ATLAS KEYPAD(4 ALARMS)
620378-5	ATLAS KEYPAD(SILENCE ALARM)
620378-6	ATLAS KEYPAD(SILENCE BELL)
620379-501	MONITOR BOX W/INSERTS
620384-3C	MID LABEL W/PRINTER(CHINESE)
620384-3E	DISPLAY LABEL-MID/PRINTER/ENG
620384-3F	MID LABEL W/PRINTER (FRENCH)
620384-3G	MID LABEL W/PRINTER (GERMAN)

Table B-8. Atlas 622SP repair parts.

Part#	Description
620384-3I	MID LABEL W/PRINTER (ITALIAN)
620384-3J	MID LABEL W/PRINTER (JAPANESE)
620384-3P	MID LABEL W/PRINTER (PORT)
620384-3S	LOW LABEL W/PRINTER (SPANISH)
620385	SUB-LABEL DISPLAY
620386	FASTON TAB
620388-1	LABEL, NONIN SENSOR
620393	PWR SUPPLY INSULATOR LABEL
620394-1	WASHER, SHOULDER PLATED
620395-501	REPLACEMENT BATTERY SUB ASSY
620403	FLAT TIE HOLDER
761077-1	WIRE TIE

Table B-9. Atlas 622NP repair parts.

Part#	Description
620004-502	ATLAS CPU PCB ASSY
620007-501	FRONT PANEL DISPLAY PCB ASSY.
620013-502	PRINTER PCB
620016-503	MAIN PCB ASSY-MID/HIGH END
620032-1	ETCO2 PCB ASSY
620034	ETCO2 CONNECTOR & CABLE
620038	NELLCOR LABEL (CARTON)
6200-43E	SERVICE MANUAL (ATLAS)
620105-3	BATTERY DOOR
620117	PRINTER DOOR BUTTON
620119	LATCH SPO2
620125-501	MAIN CASE/HANDLE SET
620126-6	BEZEL SET/HIGH HEAT TRANSFER
620131-1	MAIN FOAM
620132-2	TOP FOAM
620133	BP FOAM
620134-501	GEAR ASSY
620138-501	PRINTER DOOR ASSY
620139-501	PRINTER FRAME ASSE
620140-501	MAIN PRINTER ASSY
620140-502	PRINTER ASSY W/STATIC BAG
620141	METAL HOUSING - TOP
620142-1	METAL HOUSING-BOTTOM (LG)
620143	NUT TEMPERATURE
620144	BRACKET SPO2
620148	GASKET CO2 EXHAUST
620149	FITTING,1/16 X 1/8-27 NPT
620150-1	AC/DC POWER SUPPLY
620156	PUMP
620157	STEPPER VALVE
620158	CHECK VALVE
620163	CABLE ASSY -PUMP/PNEUMATIC VLV
620165	CABLE-CONN TO MAIN BD,ECG

Table B-9. Atlas 622NP repair parts.

Part#	Description
620167	CABLE-MAIN BD TO DISPLAY BD
620168-2	CABLE ASSY POWER SUPPLY
620170	CABLE ASSY NELLCOR
620171	CABLE ASSY SPEAKER
620172-2	CABLE ASSY AC
620173	CABLE-TEMP SENSOR TO MAIN BD
620175	CABLE ASSY - FAN
620176	CABLE ASSY - PRINTER
620177	CABLE ASSY - PRINT HEAD
620178	CABLE ASSY SP02
620181-3	LABEL,BOTTOM,HIGH END
620182	LABEL - RS232
620187-501	PNEUMATIC SUB ASSY
620189	4-20 X 5/16 SLT/TORX PN PL ZIN
620192-1	PNEUMATIC CONNECTOR
620193	NUT, HEX 5/16-32 X.095 PNEUM
620194	WASHER,FLT.33 X.62 X.049 PNEUM
620197	BUSHING, SPLIT NYLON
620198	FOOT
620200-501	CRT SUB ASY
620205	4-40 X .31 TX PN MC ST ZN
620207	NUT, M3-.5 HEX KEPS ST ZN
620214-1	TUBING, SILICONE, 1/16 .50
620215-1	TUBING, SILICONE 1/8 X1.00
620215-2	TUBING, SILICONE 1/8 X 2.125
620215-3	TUBING, SILICONE 1/8 X 7.50
620215-4	TUBING, SILICONE 1/8 X.750
620216	FITTING “Y” 1/8 X 1/8 X 1/8
620217	FITTING, “T”, 1/8 X 1/16X 1/8
620377-1	NELLCOR WORKS HERE”” LABEL
620377-2	NELLCOR PATENT LABEL
620378-1	ATLAS KEYPAD(BP START/CANCEL)
620378-2	ATLAS KEYPAD(TREND/LEAD/PRINT)
620378-3	ATLAS KEYPAD(SP02/CLOCK/POWER)

Table B-9. Atlas 622NP repair parts.

Part#	Description
620378-4	ATLAS KEYPAD(4 ALARMS)
620378-5	ATLAS KEYPAD(SILENCE ALARM)
620378-6	ATLAS KEYPAD(SILENCE BELL)
620379-501	MONITOR BOX W/INSERTS
620384-5C	HIGH LABEL (CHINESE)
620384-5E	DISPLAY LABEL-HIGH/PRINTER/ENG
620384-5F	HIGH LABEL (FRENCH)
620384-5G	HIGH LABEL (GERMAN)
620384-5I	HIGH LABEL (ITALIAN)
620384-5J	HIGH LABEL (JAPANESE)
620384-5P	HIGH LABEL (PORT)
620384-5S	HIGH LABEL (SPANISH)
620385	SUB-LABEL DISPLAY
620386	FASTON TAB
620388-2	LABEL, NELLCOR SENSOR
620393	PWR SUPPLY INSULATOR LABEL
620394-1	WASHER, SHOULDER PLATED
620395-501	REPLACEMENT BATTERY SUB ASSY
620403	FLAT TIE HOLDER
620411-1C	PRYON CO2 CAUTION LABEL (Chinese)
620411-1E	PRYON CO2 CAUTION LABEL (English)
620411-1F	PRYON CO2 CAUTION LABEL (French)
620411-1G	PRYON CO2 CAUTION LABEL (German)
620411-1J	PRYON CO2 CAUTION LABEL (Japanese)
620411-1P	PRYON CO2 CAUTION LABEL (Port)
620411-1S	PRYON CO2 CAUTION LABEL (Spanish)
620524	CABLE-CO2 TO MAIN BD
620530	D CONN.LOCATOR\NELLCOR MP506
620531	CABLE ASSY,NELLCOR MP506 SEN.
620532	NELLCOR MP506 SPO2 PCB
623NP-ACCKT	ATLAS ACC KIT/HIGH/NEL-W/PRNT
761077-1	WIRE TIE

Table B-10. Atlas 623SP repair parts.

Part#	Description
620004-502	ATLAS CPU PCB ASSY
620007-501	FRONT PANEL DISPLAY PCB ASSY.
620013-502	PRINTER PCB
620016-503	MAIN PCB ASSY-MID/HIGH END
620032-1	ETCO2 PCB ASSY
620034	ETCO2 CONNECTOR & CABLE
6200-43E	SERVICE MANUAL (ATLAS)
620105-3	BATTERY DOOR
620117	PRINTER DOOR BUTTON
620119	LATCH SPO2
620125-501	MAIN CASE/HANDLE SET
620126-6	BEZEL SET/HIGH HEAT TRANSFER
620131-1	MAIN FOAM
620132-2	TOP FOAM
620133	BP FOAM
620134-501	GEAR ASSY
620138-501	PRINTER DOOR ASSY
620139-501	PRINTER FRAME ASSE
620140-501	MAIN PRINTER ASSY
620140-502	PRINTER ASSY W/STATIC BAG
620141	METAL HOUSING - TOP
620142-1	METAL HOUSING-BOTTOM (LG)
620143	NUT TEMPERATURE
620144	BRACKET SPO2
620148	GASKET CO2 EXHAUST
620149	FITTING,1/16 X 1/8-27 NPT
620150-1	AC/DC POWER SUPPLY
620156	PUMP
620157	STEPPER VALVE
620158	CHECK VALVE
620163	CABLE ASSY -PUMP/PNEUMATIC VLV
620165	CABLE-CONN TO MAIN BD,ECG
620167	CABLE-MAIN BD TO DISPLAY BD

Table B-10. Atlas 623SP repair parts.

Part#	Description
620168-2	CABLE ASSY POWER SUPPLY
620171	CABLE ASSY SPEAKER
620172-2	CABLE ASSY AC
620173	CABLE-TEMP SENSOR TO MAIN BD
620175	CABLE ASSY - FAN
620176	CABLE ASSY - PRINTER
620177	CABLE ASSY - PRINT HEAD
620181-3	LABEL,BOTTOM,HIGH END
620182	LABEL - RS232
620187-501	PNEUMATIC SUB ASSY
620189	4-20 X 5/16 SLT/TORX PN PL ZIN
620192-1	PNEUMATIC CONNECTOR
620193	NUT, HEX 5/16-32 X.095 PNEUM
620194	WASHER,FLT.33 X.62 X.049 PNEUM”
620197	BUSHING, SPLIT NYLON
620198	FOOT
620200-501	CRT SUB ASY
620205	4-40 X .31 TX PN MC ST ZN
620207	NUT, M3-.5 HEX KEPS ST ZN
620214-1	TUBING, SILICONE, 1/16 .50
620215-1	TUBING, SILICONE 1/8 X1.00
620215-2	TUBING, SILICONE 1/8 X 2.125
620215-3	TUBING, SILICONE 1/8 X 7.50
620215-4	TUBING, SILICONE 1/8 X.750
620216	FITTING “Y” 1/8 X 1/8 X 1/8
620217	FITTING, “T”, 1/8 X 1/16X 1/8
620373-501	NONIN SUB ASSEMBLY
620378-1	ATLAS KEYPAD(BP START/CANCEL)
620378-2	ATLAS KEYPAD(TREND/LEAD/PRINT)
620378-3	ATLAS KEYPAD(SP02/CLOCK/POWER)
620378-4	ATLAS KEYPAD(4 ALARMS)
620378-5	ATLAS KEYPAD(SILENCE ALARM)
620378-6	ATLAS KEYPAD(SILENCE BELL)
620379-501	MONITOR BOX W/INSERTS

Table B-10. Atlas 623SP repair parts.

Part#	Description
620384-5C	HIGH LABEL
620384-5E	DISPLAY LABEL-HIGH/PRINTER/ENG
620384-5F	HIGH LABEL (FRENCH)
620384-5G	HIGH LABEL (GERMAN)
620384-5I	HIGH LABEL (ITALIAN)
620384-5J	HIGH LABEL (JAPANESE)
620384-5P	HIGH LABEL (PORT)
620384-5S	HIGH LABEL (SPANISH)
620385	SUB-LABEL DISPLAY
620386	FASTON TAB
620388-1	LABEL, NONIN SENSOR
620393	PWR SUPPLY INSULATOR LABEL
620394-1	WASHER, SHOULDER PLATED
620395-501	REPLACEMENT BATTERY SUB ASSY
620403	FLAT TIE HOLDER
620411-1C	PRYON CO2 CAUTION LABEL (Chinese)
620411-1E	PRYON CO2 CAUTION LABEL (English)
620411-1F	PRYON CO2 CAUTION LABEL (French)
620411-1G	PRYON CO2 CAUTION LABEL (German)
620411-1I	PRYON CO2 CAUTION LABEL (Italian)
620411-1J	PRYON CO2 CAUTION LABEL (Japanese)
620411-1P	PRYON CO2 CAUTION LABEL (Port)
620411-1S	PRYON CO2 CAUTION LABEL (Spanish)
620524	CABLE-CO2 TO MAIN BD
761077-1	WIRE TIE

Table B-11. Atlas 623NP repair parts.

Part#	Description
620004-502	ATLAS CPU PCB ASSY
620007-501	FRONT PANEL DISPLAY PCB ASSY.
620013-502	PRINTER PCB
620016-503	MAIN PCB ASSY-MID/HIGH END
620032-1	ETCO2 PCB ASSY
620034	ETCO2 CONNECTOR & CABLE
620038	NELLCOR LABEL (CARTON)
6200-43E	SERVICE MANUAL (ATLAS)
620105-3	BATTERY DOOR
620117	PRINTER DOOR BUTTON
620119	LATCH SPO2
620125-501	MAIN CASE/HANDLE SET
620126-6	BEZEL SET/HIGH HEAT TRANSFER
620131-1	MAIN FOAM
620132-2	TOP FOAM
620133	BP FOAM
620134-501	GEAR ASSY
620138-501	PRINTER DOOR ASSY
620139-501	PRINTER FRAME ASSE
620140-501	MAIN PRINTER ASSY
620140-502	PRINTER ASSY W/STATIC BAG
620141	METAL HOUSING - TOP
620142-1	METAL HOUSING-BOTTOM (LG)
620143	NUT TEMPERATURE
620144	BRACKET SPO2
620148	GASKET CO2 EXHAUST
620149	“FITTING,1/16 X 1/8-27 NPT “
620150-1	AC/DC POWER SUPPLY
620156	PUMP
620157	STEPPER VALVE
620158	CHECK VALVE
620163	CABLE ASSY -PUMP/PNEUMATIC VLV
620165	“CABLE-CONN TO MAIN BD,ECG “

Table B-11. Atlas 623NP repair parts.

Part#	Description
620167	CABLE-MAIN BD TO DISPLAY BD
620168-2	CABLE ASSY POWER SUPPLY
620170	CABLE ASSY NELLCOR
620171	CABLE ASSY SPEAKER
620172-2	CABLE ASSY AC
620173	CABLE-TEMP SENSOR TO MAIN BD
620175	CABLE ASSY - FAN
620176	CABLE ASSY - PRINTER
620177	CABLE ASSY - PRINT HEAD
620178	CABLE ASSY SP02
620181-3	“LABEL,BOTTOM,HIGH END “
620182	LABEL - RS232
620187-501	PNEUMATIC SUB ASSY
620189	4-20 X 5/16 SLT/TORX PN PL ZIN
620192-1	PNEUMATIC CONNECTOR
620193	“NUT, HEX 5/16-32 X.095 PNEUM “
620194	“WASHER,FLT.33 X.62 X.049 PNEUM”
620197	“BUSHING, SPLIT NYLON “
620198	FOOT
620200-501	CRT SUB ASY
620205	4-40 X .31 TX PN MC ST ZN
620207	“NUT, M3-.5 HEX KEPS ST ZN “
620214-1	“TUBING, SILICONE, 1/16.50”” “
620215-1	“TUBING, SILICONE 1/8 X1.00”” “
620215-2	“TUBING, SILICONE 1/8 X 2.125”” “
620215-3	“TUBING, SILICONE 1/8 X 7.50”” “
620215-4	“TUBING, SILICONE 1/8 X.750”” “
620216	“FITTING ““Y”” 1/8 X 1/8 X 1/8 “
620217	“FITTING, ““T””, 1/8 X 1/16X 1/8 “
620377-1	“““NELLCOR WORKS HERE”” LABEL “
620377-2	NELLCOR PATENT LABEL
620378-1	ATLAS KEYPAD(BP START/CANCEL)
620378-2	ATLAS KEYPAD(TREND/LEAD/PRINT)
620378-3	ATLAS KEYPAD(SP02/CLOCK/POWER)

Table B-11. Atlas 623NP repair parts.

Part#	Description
620378-4	ATLAS KEYPAD(4 ALARMS)
620378-5	ATLAS KEYPAD(SILENCE ALARM)
620378-6	ATLAS KEYPAD(SILENCE BELL)
620379-501	MONITOR BOX W/INSERTS
620384-5C	HIGH LABEL (CHINESE)
620384-5E	DISPLAY LABEL-HIGH/PRINTER/ENG
620384-5F	HIGH LABEL (FRENCH)
620384-5G	HIGH LABEL (GERMAN)
620384-5I	HIGH LABEL (ITALIAN)
620384-5J	HIGH LABEL (JAPANESE)
620384-5P	HIGH LABEL (PORT)
620384-5S	HIGH LABEL (SPANISH)
620385	SUB-LABEL DISPLAY
620386	FASTON TAB
620388-2	“LABEL, NELLCOR SENSOR “
620393	PWR SUPPLY INSULATOR LABEL
620394-1	“WASHER, SHOULDER PLATED “
620395-501	REPLACEMENT BATTERY SUB ASSY
620403	FLAT TIE HOLDER
620411-1C	PRYON CO2 CAUTION LABEL (Chinese)
620411-1E	PRYON CO2 CAUTION LABEL (English)
620411-1F	PRYON CO2 CAUTION LABEL (French)
620411-1G	PRYON CO2 CAUTION LABEL (German)
620411-1J	PRYON CO2 CAUTION LABEL (Japanese)
620411-1P	PRYON CO2 CAUTION LABEL (Port)
620411-1S	PRYON CO2 CAUTION LABEL (Spanish)
620524	CABLE-CO2 TO MAIN BD
620530	D CONN.LOCATOR\NELLCOR MP506
620531	“CABLE ASSY,NELLCOR MP506 SEN. “
620532	NELLCOR MP506 SPO2 PCB
623NP-ACCKT	ATLAS ACC KIT/HIGH/NEL-W/PRNT
761077-1	WIRE TIE

REV	DESCRIPTION	ECN/ECO	INIT	DATE	CKD
A	RELEASE TO PROD. ENG.	5-40138	JRS	8/27/99	T.W.

PRINT HEAD
ALL YELLOW
CABLE ASSEMBLY PRINT HEAD
CABLE ASSY PRINTHEAD ESD GROUND
TO POWER SUPPLY CAN
RECORDER BOARD
MOTOR
STEPPER MOTOR
CABLE ASSY MOTOR ESD GROUND
TO POWER SUPPLY CAN
BATTERY
FUSE
YOKE
YOKE AND CABLE ASSY
ANODE
6 POSITION JUMPER
DEFLECTION BOARD
CABLE ASSY BATTERY
FAN
CABLE ASSY FAN
POWER SUPPLY
FERRITE
IN-LINE FUSE
A/C RECEPTICLE
GND ATTACHES TO PCA WITH FASTON
CABLE ASSY AC RECEPTACLE
GND ATTACHED TO PS CAN WITH SCREW
CPU BOARD
CABLE ASSY PRINTER
RIBBON CABLE
CABLE ASSY DISPLAY
RIBBON CABLE
FERRITE
SPEAKER
CABLE ASSY CO2
FERRITE
CO2 BOARD
DISPLAY BOARD
CABLE ASSY NELCOR
RIBBON CABLE
SILENCE BOARD
MAIN BOARD
CABLE ASSY POWER SUPPLY
CABLE ASSY SPEAKER
5 POSITION JUMPER
CABLE ASSY PUMP/PNEUTRONICS VALVE
PUMP
VALVE
SPO2 BOARD NELLCOR
CABLE ASSY NONIN
SPO2 BOARD NONIN
DISPLAY BOARD 2
ETCO2 CONNECTOR WITH SWITCH
CO2 RECEIVER
FERRITE
CABLE ASSY NELLCOR SENSOR
CABLE ASSY SPO2 ESD GROUND
GND ATTACHED TO SPO2 BRACKET WITH SCREW
CABLE ASSY NONIN SENSOR
CABLE ASSY TEMPERATURE CONNECTOR
TEMP
CABLE ASSY ECG
ECG
SPO2 CONNECTOR NELLOR
SPO2 CONNECTOR NONIN

-	-
PART NO.	DESCRIPTION

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DRAWN WJM/JBE	DATE 7-8-99	Welch Allyn
APPROVED ZIP	DATE 8/27/99	MATERIAL: -
REL TO PROD RPD	DATE 8/15/99	FINISH: -
-	-	TITLE: INTERCONNECT DIAGRAM
CAD SOFTWARE: PROE		
TRANSLATED FROM: METO		
UNLESS OTHERWISE SPECIFIED TOLERANCES DIMENSIONS .XX = ±.02 .XXX = ±.005 ANGLES ±2° ARE IN INCHES	D	DRAWING NO. 620396 REV A
	SCALE NONE	SHEET 1 of 1

Figure C-1. Atlas Interconnect Diagram.

REV	Description	ECN/ECO	Init	Date	Ckd
A	Release to Production	S-39118	JAC	3/15/99	LPP
B	See ECN worksheet	S-39456	LPP	4/27/99	LPP
C	Improvements for ESD and Fast Transients	S-39822	LPP	6/23/99	LPP
D	Mods to U2 clock line, NVRAM pullup	S-39934	LPP	7/9/99	LPP
F	Add Nellcor SpO2 cabability. Modify RLD to reduce V-lead noise. Improve ESU rejection.	S-44460	LPP	3/26/02	JK
G	Add 330uF bypass for Nellcor 506 board.	S-44857	LPP	7/18/02	JK

	Initial	Date
Drawn	Rick Myers	3/05/99
Designed	Rick Myers	3/05/99
Checked	L.Phillips	3/16/99
Approved	Z. Psenicnik	3/16/99
Release For Production	J. Bello	3/17/99

Welch Allyn Inc.

Schematic: 620002.dsn

Title: Main Board - Model 200

Size: C | Document Number: 620002 | Rev: G

Date: Monday, August 05, 2002 | Sheet 1 of 6

Figure D-1. Atlas model 200 main board.

REV	Description	ECN/ECO	Init	Date	Ckd
A	Release to Production	S-39118	JAC	3/15/99	LPP
B	See ECN worksheet	S-39456	LPP	4/27/99	LPP
C	Improvements for ESD and Fast Transients	S-39822	LPP	6/23/99	LPP
D	Mods to U2 clock line, NVRAM pullup	S-39934	LPP	7/9/99	LPP
F	Add Nellcor SpO2 cabability. Modify RLD to reduce V-lead noise. Improve ESU rejection.	S-44460	LPP	3/26/02	JK
G	Add 330uF bypass for Nellcor S06 board.	S-44857	LPP	7/18/02	JK

Primary Transducer

0mmHG = 0.5V

300mmHG = 4.0V

Zero Adjust

+/-20mmHg range

PWM D/A

76.8KHz

Safety Transducer

Zero Offset

A/D Mux

Over Pressure Fault Circuit

NIBP PWM A/D Converter

	Initial	Date
Drawn	Rick Myers	3/05/99
Designed	Rick Myers	3/05/99
Checked	L.Phillips	3/16/99
Approved	Z. Psenicnik	3/16/99
Release For Production	J. Bello	3/17/99

Welch Allyn Inc.

Schematic: 620002.dsn

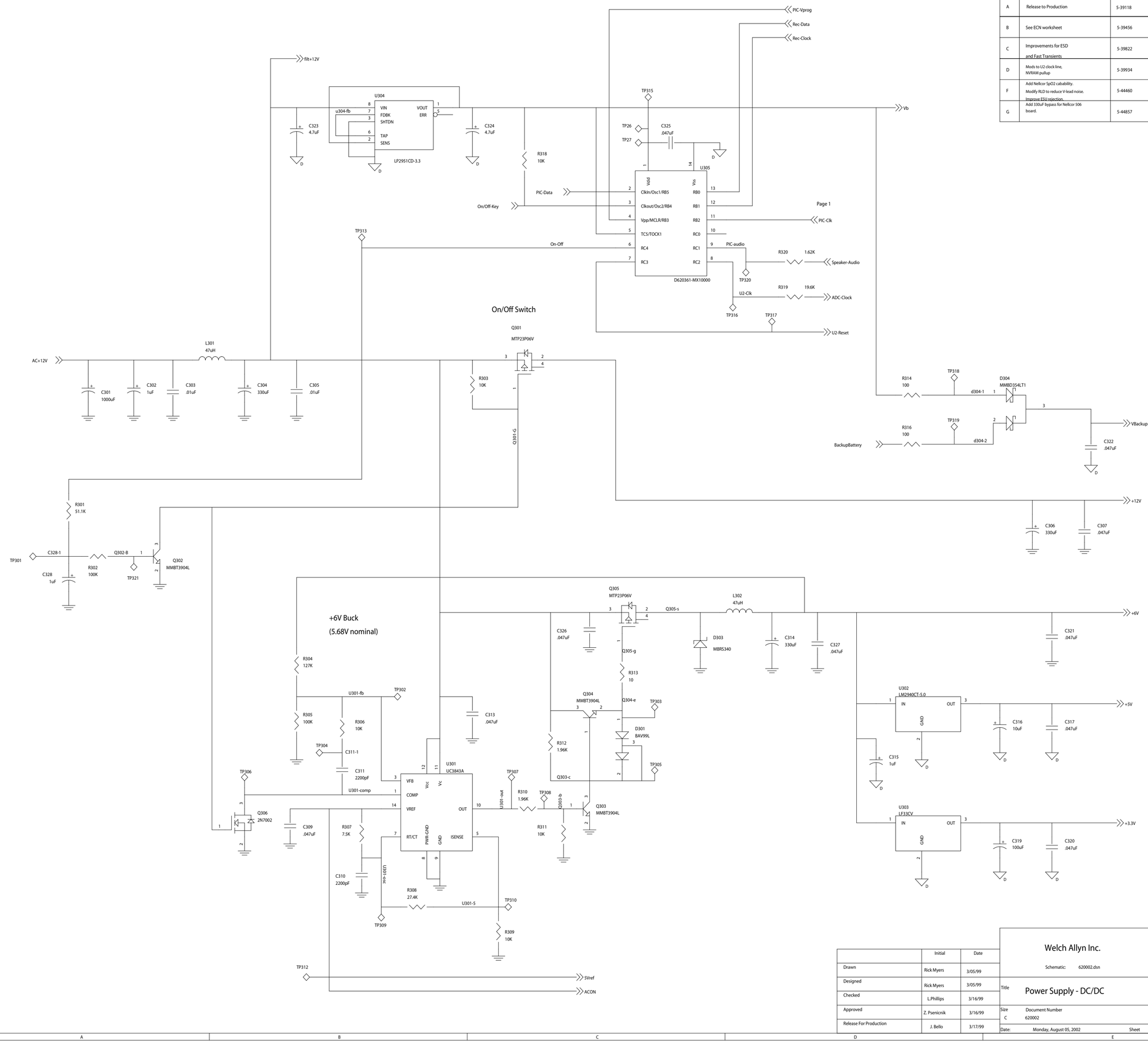
Title: NIBP Electronics

Size: C | Document Number: 620002 | Rev: G

Date: Monday, August 05, 2002 | Sheet 2 of 6

Figure D-2. Atlas model 200 NIBP electronics.

REV	Description	ECN/ECO	Init	Date	Ckd
A	Release to Production	5-39118	JAC	3/15/99	LPP
B	See ECN worksheet	5-39456	LPP	4/27/99	LPP
C	Improvements for ESD and Fast Transients	5-39822	LPP	6/23/99	LPP
D	Mods to U2 clock line, NVRAM pullup	5-39934	LPP	7/9/99	LPP
F	Add Nellcor SpO2 cabability. Modify RLD to reduce V-lead noise. Improve ESU rejection.	5-44460	LPP	3/26/02	JK
G	Add 330uF bypass for Nellcor S06 board.	5-44857	LPP	7/18/02	JK



	Initial	Date
Drawn	Rick Myers	3/05/99
Designed	Rick Myers	3/05/99
Checked	L.Phillips	3/16/99
Approved	Z. Psenicnik	3/16/99
Release For Production	J. Bello	3/17/99

Welch Allyn Inc.

Schematic: 620002.dsn

Title: Power Supply - DC/DC

Size: C | Document Number: 620002 | Rev: G

Date: Monday, August 05, 2002 | Sheet 3 of 6

Figure D-3. Atlas model 200 power supply

REV	Description	ECN/ECO	Init	Date	Ckd
A	Release to Production	5-39118	JAC	3/15/99	LPP
B	See ECN worksheet	5-39456	LPP	4/27/99	LPP
C	Improvements for ESD and Fast Transients	5-39822	LPP	6/23/99	LPP
D	Mods to U2 clock line, NVRAM pullup	5-39934	LPP	7/9/99	LPP
F	Add Nellcor SpO2 cabability. Modify RLD to reduce V-lead noise. Improve ESU rejection	5-44460	LPP	3/26/02	JK
G	Add 330uF bypass for Nellcor 506 board.	5-44857	LPP	7/18/02	JK

Isolation Barrier

Isolated SpO2 Circuits

Grounded SpO2 Circuits

Nonin SpO2 Connector

Nellcor SpO2 Connector

	Initial	Date
Drawn	Rick Myers	3/05/99
Designed	Rick Myers	3/05/99
Checked	L.Phillips	3/16/99
Approved	Z. Psenicnik	3/16/99
Release For Production	J. Bello	3/17/99

Welch Allyn Inc.

Schematic: 620002.dsn

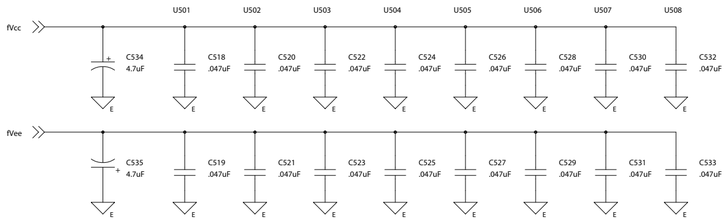
Title: Isolated Power and SpO2 interface

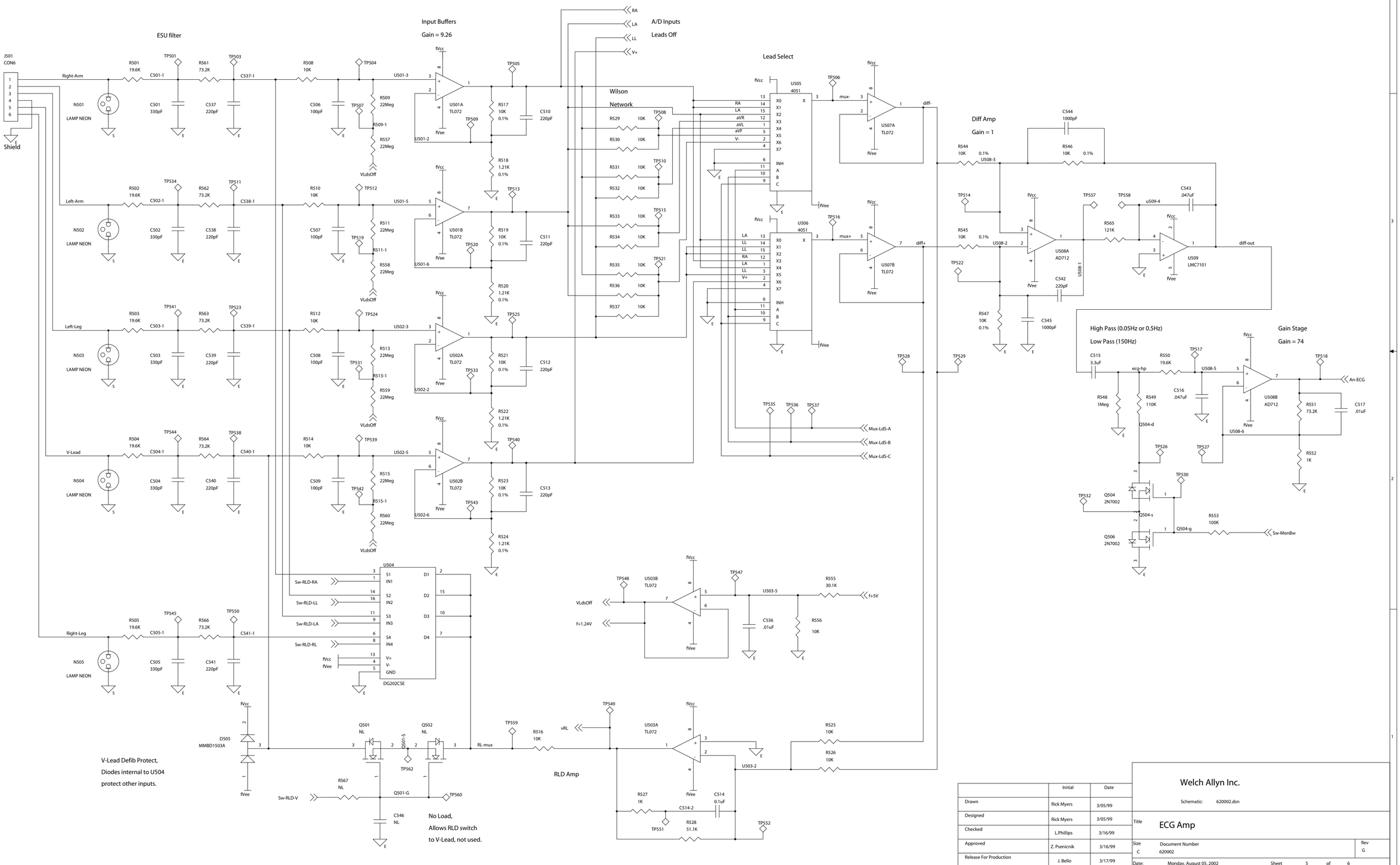
Size: C | Document Number: 620002 | Rev: G

Date: Monday, August 05, 2002 Sheet 4 of 6

Figure D-4. Atlas Power isolation /SpO_2 interface.

REV	Description	ECN/ECO	Init	Date	Ckd
A	Release to Production	5-39118	JAC	3/15/99	LPP
B	See ECN worksheet	5-39456	LPP	4/27/99	LPP
C	Improvements for ESD and Fast Transients	5-39822	LPP	6/23/99	LPP
D	Mods to U2 clock line, NVRAM pullup	5-39934	LPP	7/9/99	LPP
F	Add Nellcor SpO2 cabability. Modify RLD to reduce V-lead noise. Improve ESU rejection.	5-44460	LPP	3/26/02	JK
G	Add 330uF bypass for Nellcor 506 board.	5-44857	LPP	7/18/02	JK





	Initial	Date
Drawn	Rick Myers	3/05/99
Designed	Rick Myers	3/05/99
Checked	L.Phillips	3/16/99
Approved	Z. Psenicnik	3/16/99
Release For Production	J. Bello	3/17/99

Welch Allyn Inc.

Schematic: 620002.dsn

Title: ECG Amp

Size: C | Document Number: 620002 | Rev: G

Date: Monday, August 05, 2002 | Sheet 5 of 6

Figure D-5. Atlas model 200 ECG amp.

REV	Description	ECN/ECO	Init	Date	Ckd
A	Release to Production	5-39118	JAC	3/15/99	LPP
B	See ECN worksheet	5-39456	LPP	4/27/99	LPP
C	Improvements for ESD	5-39822	LPP	6/23/99	LPP
D	and Fast Transients Mods to U2 clock line, NVRAM pullup	5-39934	LPP	7/9/99	LPP
F	Add Nellcor SpO2 cabability. Modify RLD to reduce V-lead noise. Improve ESU rejection.	5-44460	LPP	3/26/02	JK
G	Add 330uF bypass for Nellcor 506 board.	5-44857	LPP	7/18/02	JK

fVcc
fVee
f+5V
iso+5Vdig
f+1.24V
U601 U602 U603
C622 .047uF
C609 4.7uF
C623 .047uF
C624 .047uF
C625 .047uF
C614 4.7uF
C626 .047uF
C627 .047uF
U604
C631 4.7uF
R623 46.4K
R622 46.4K
U607B LM393
U607A LM393
Sw-RLD-V
Sw-MonBw
SpO2-Reset
SW-RL-V
Sw-DiagBw
Sw-RLD-RL
Sw-RLD-LL
TP601 TP602 TP603 TP604 TP605 TP621 TP622 TP625
C629 .047uF
Serial/Parallel
Control Data
U605 74HCT595
U605-out
U606 74HCT595
Sw-RLD-LA
Sw-RLD-RA
Mux-Ld5-C
Mux-Ld5-B
Mux-Ld5-A
Mux-A/D-C
Mux-A/D-B
Mux-A/D-A
TP623 TP624
U605-12
TP606
C637 1000pF
R628 10K
TP607 TP608 TP609
A/D Mux
U603 4051
vRL
RA
LA
LL
V+
An-ECG
TP610 TP611 TP612
R605 3.48K
R607 464K
U603-out
U602-2
U602-5
U602-7
R608 1K
TP613
C603 680pF
TP614
R601 10K
U601-3
R602 73.2K
U601A MC34072
U601-1
R606 3.48K
TP616
U602-3
U602 LM311
TP617
R603 46.4K
U601-2
C601 1000pF
TP618
TP619
R604 10K
D601-2
D601 MMBD1503A
TP630
U604E 74HCT04
U604-10
PWM
A/D
Converter
U604A 74HCT04
U604-2
U604-1
TP627
R625 10K
C634 220pF
R613 6.19K
C641 0.1uF
U613-6
U613 HCNW4503
iso604-a
R619 619
FE-Data-In
U604B 74HCT04
U604-4
U604-3
TP628
R626 10K
C635 220pF
R615 6.19K
C642 0.1uF
U612-6
U612 HCNW4503
iso603-a
R620 619
FE-Data-Clock
U604C 74HCT04
U604-6
U604-5
TP629
R627 5.11K
C636 100pF
R617 2.15K
C628 0.1uF
U611-6
U611 HCNW4503
iso602-a
R621 215
FE-ADC-Clock
U604D 74HCT04
U604-8
TP615
Q601 MMBT3904L
Q601-e
R610 511
iso601-a
C632 .047uF
R611 6.19K
C621 0.1uF
U610-6
U610 HCNW4503
R624 5.11K
TP626
FE-PWM-ADC
C633 100pF
Isolation
Barrier
U601B MC34072
U601-7
TP620
U604F 74HCT04
Integrator
Input
(U604-10)
Comparator
Inputs
Analog In
PWM-Out
(U604-8)
52uSec
781uSec
+5V
-5V
PWM-timer

	Initial	Date
Drawn	Rick Myers	3/05/99
Designed	Rick Myers	3/05/99
Checked	L.Phillips	3/16/99
Approved	Z. Psenicnik	3/16/99
Release For Production	J. Bello	3/17/99

Welch Allyn Inc.

Schematic: 620002.dsn

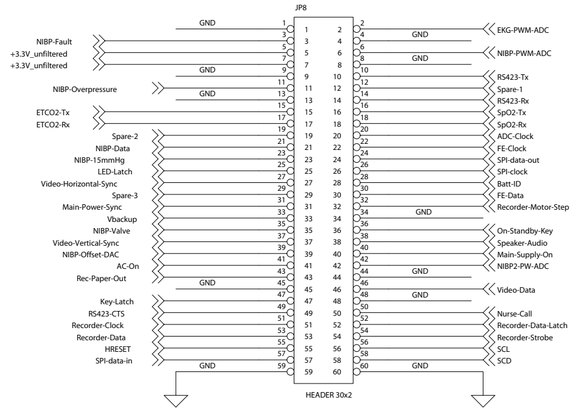
Title: ECG A/D and Interface

Size: C | Document Number: 620002 | Rev: F

Date: Monday, August 05, 2002 | Sheet 6 of 6

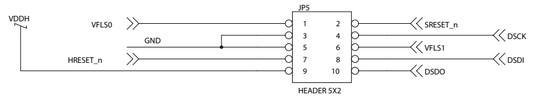
REV	Description	ECN/ECO	Init	Date	Ckd
A	Release to Production	5-39173	JAC	3/18/99	LPP
B	Component change for frequency modulation	5-39353	JJC	4/15/99	ZIP
C	Change Reset IC U3, No Load C40	5-39830	LPP	6/24/99	LPP
D	Upgrade to larger SDRAM	5-44759 LPP	6/20/02 JK		

Main PCA Connectors



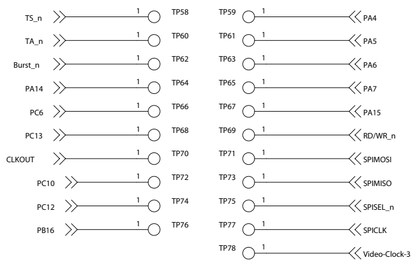
CPU PCA SW Debug Port

(aka BDM Connector)



1 - Visual History Buffer Flush Status ('823 output)
2 - Reset Output ('823 input)
3 - Ground
4 - BDM Clock ('823 input)
5 - Ground
6 - Visual History Buffer Flush Status ('823 output)
7 - Reset Input ('823 Output)
8 - BDM Data Input ('823 Input)
9 - Vcc
10 - BDM Data Output ('823 Output)

Test Points



	Initial	Date
Drawn	Jim Belesiu	Mar 5, 1999
Designed	Jim Belesiu	Mar 5, 1999
Checked	L. Phillips	3/19/99
Approved	Z. Psenicnik	3/19/99
Release For Production	J. Bello	3/19/99

Welch Allyn Inc.

Schematic: 620005.dsn

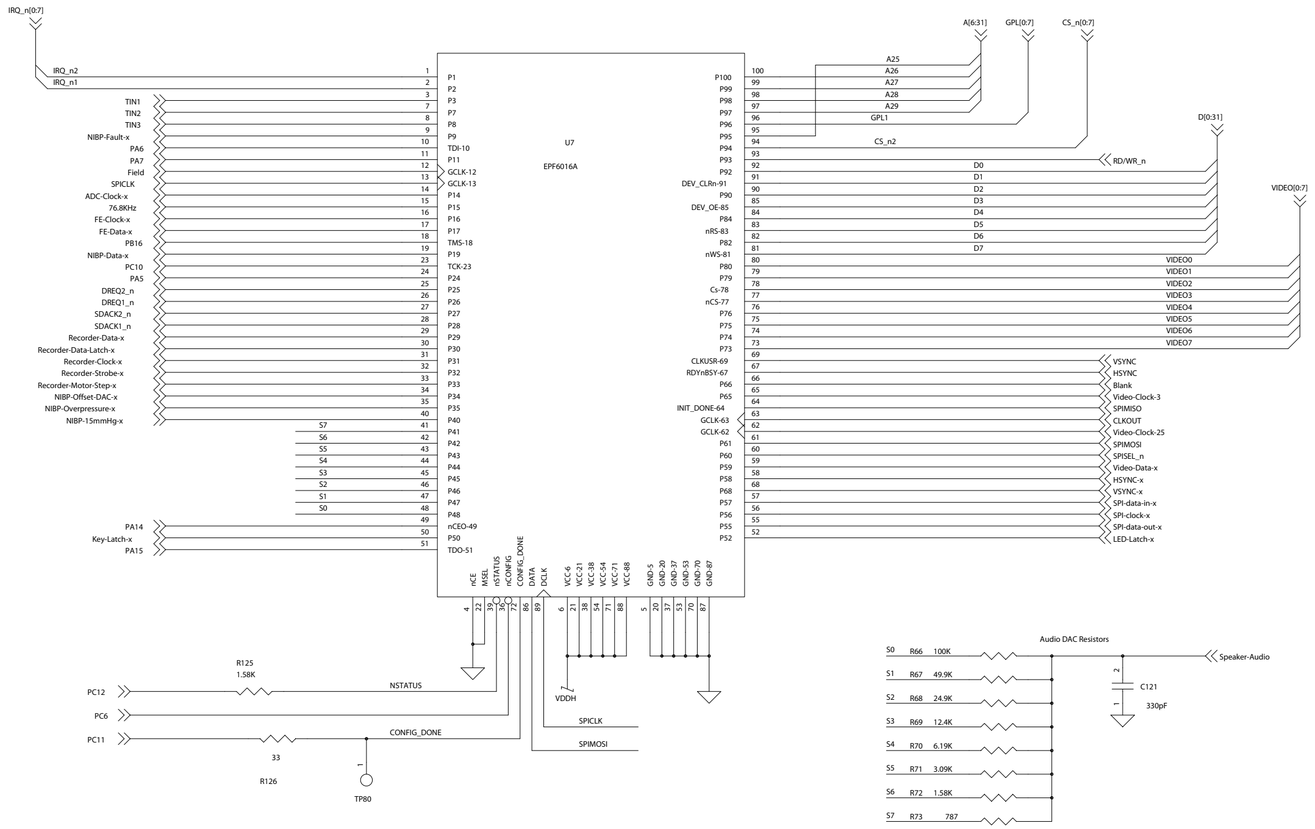
Title: Atlas CPU Subsystem

Size: C | Document Number: 620005 | Rev: D

Date: Monday, August 05, 2002 Sheet 1 of 6

Figure D-7. Atlas CPU subsystem.

REV	Description	ECN/ECO	Init	Date	Ckd
A	Release to Production	5-39173	JAC	3/18/99	LPP
B	Component change for frequency modulation	5-39353	JJC	4/15/99	ZIP
C	Change Reset IC U3, No Load C40	5-39830	LPP	6/24/99	LPP
D	Upgrade to larger SDRAM	5-44759	LPP	6/20/02 JK	



	Initial	Date
Drawn	Jim Belesiu	Mar 5, 1999
Designed	Jim Belesiu	Mar 5, 1999
Checked	L. Phillips	3/19/99
Approved	Z. Psenicnik	3/19/99
Release For Production	J. Bello	3/19/99

Welch Allyn Inc.

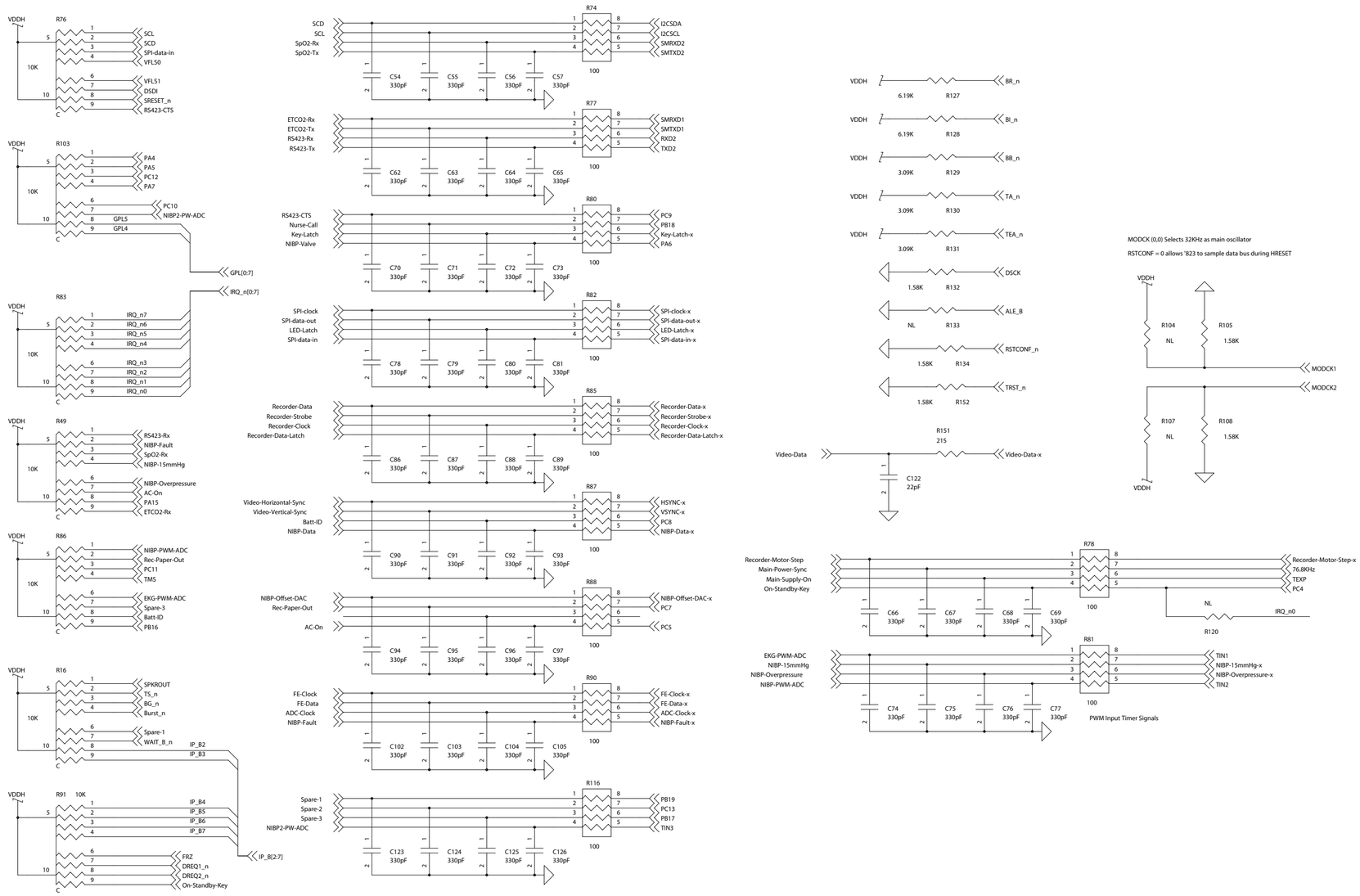
Schematic: 620005.dsn

Title: FPGA

Size: C | Document Number: 620005 | Rev: D

Date: Monday, August 05, 2002 | Sheet 2 of 6

REV	Description	ECN/ECO	Init	Date	Ckd
A	Release to Production	5-39173	JAC	3/18/99	LPP
B	Component change for frequency modulation	5-39353	JJC	4/15/99	ZIP
C	Change Reset IC U3, No Load C40	5-39830	LPP	6/24/99	LPP
D	Upgrade to larger SDRAM	5-44759 LPP	6/20/02 JK		



	Initial	Date
Drawn	Jim Belesiu	Mar 5, 1999
Designed	Jim Belesiu	Mar 5, 1999
Checked	L. Phillips	3/19/99
Approved	Z. Psenicnik	3/19/99
Release For Production	J. Bello	3/19/99

Welch Allyn Inc.

Schematic: 620005.dsn

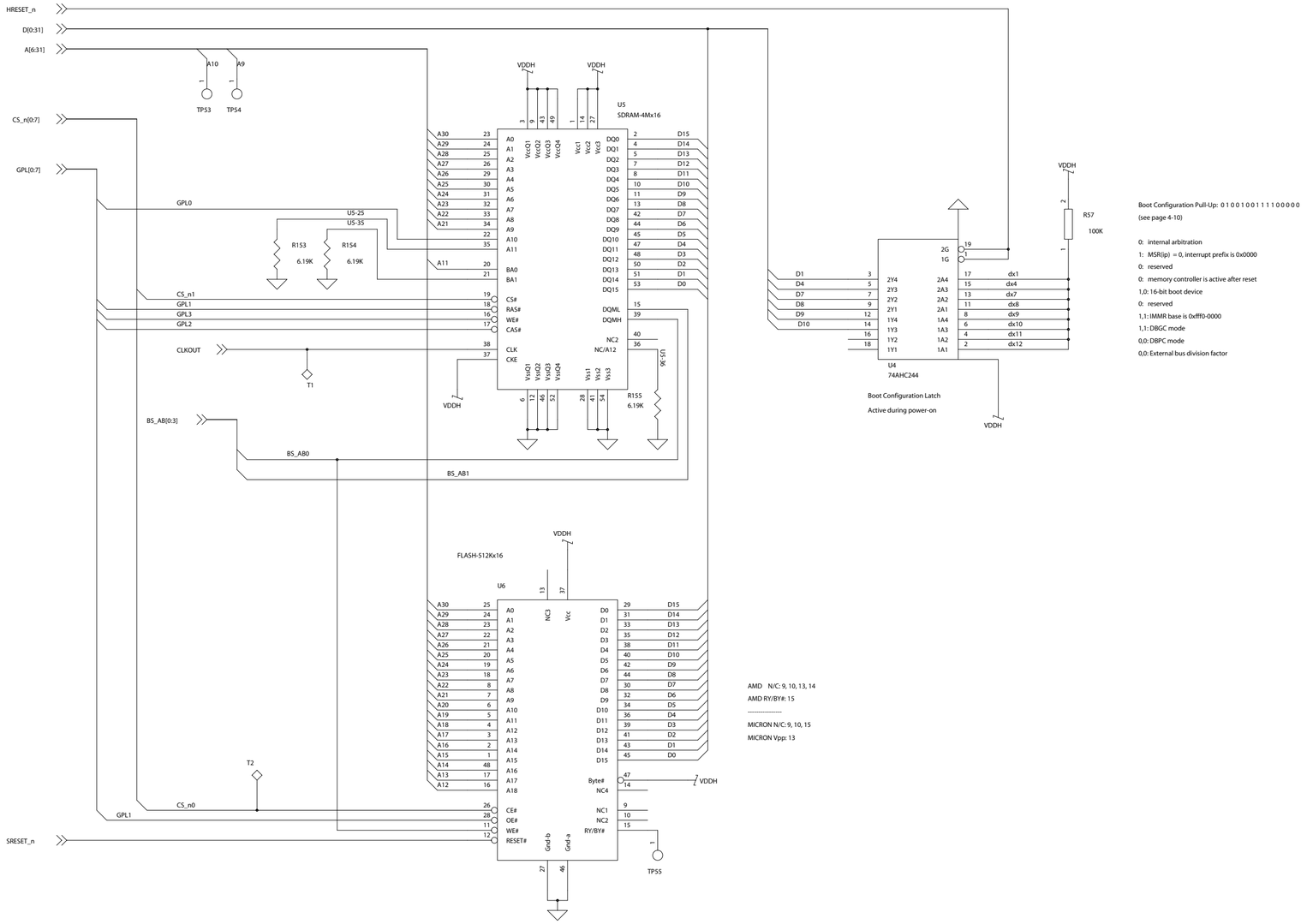
Title: I/O Filters

Size: C | Document Number: 620005 | Rev: D

Date: Monday, August 05, 2002 | Sheet 3 of 6

Figure D-9. Atlas 200/210/220 I/O filters.

REV	Description	ECN/ECO	Init	Date	Ckd
A	Release to Production	5-39173	JAC	3/18/99	LPP
B	Component change for frequency modulation	5-39353	JJC	4/15/99	ZIP
C	Change Reset IC U3, No Load C40	5-39830	LPP	6/24/99	LPP
D	Upgrade to larger SDRAM	5-44759 LPP	6/20/02 JK		



	Initial	Date
Drawn	Jim Belesiu	Mar 5, 1999
Designed	Jim Belesiu	Mar 5, 1999
Checked	L. Phillips	3/19/99
Approved	Z. Psenicnik	3/19/99
Release For Production	J. Bello	3/19/99

Welch Allyn Inc.

Schematic: 620005.dsn

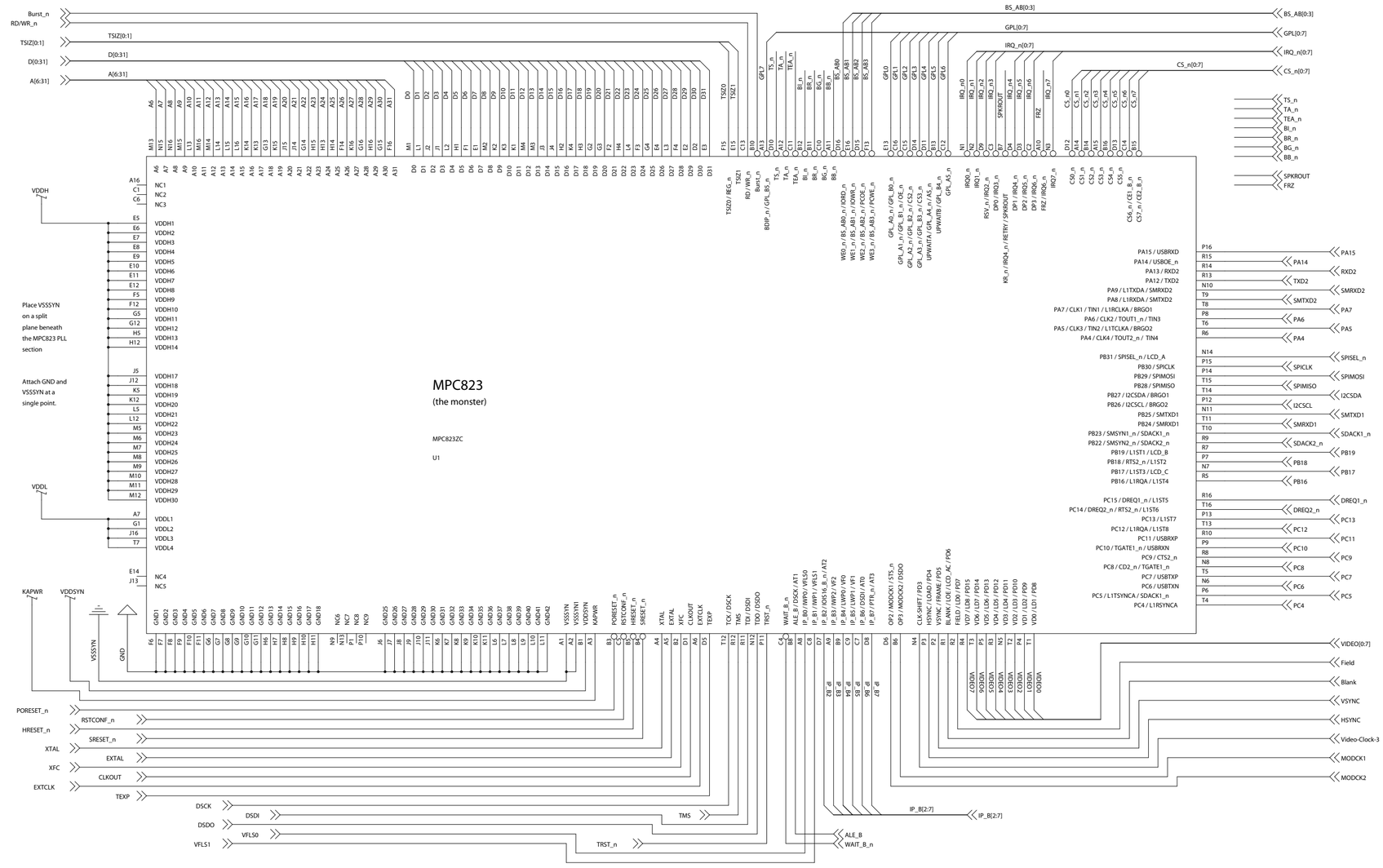
Title: Flash, SDRAM and HRESET Config Word

Size: C | Document Number: 620005 | Rev: D

Date: Monday, August 05, 2002 Sheet 4 of 6

Figure D-10. Flash, SDRAM HRESET config word.

REV	Description	ECN/ECO	Init	Date	Ckd
A	Release to Production	5-39173	JAC	3/18/99	LPP
B	Component change for frequency modulation	5-39353	JJC	4/15/99	ZIP
C	Change Reset IC U3, No Load C40	5-39830	LPP	6/24/99	LPP
D	Upgrade to larger SDRAM	5-44759 LPP	6/20/02 JK		



	Initial	Date
Drawn	Jim Belesiu	Mar 5, 1999
Designed	Jim Belesiu	Mar 5, 1999
Checked	L. Phillips	3/19/99
Approved	Z. Psenicnik	3/19/99
Release For Production	J. Bello	3/19/99

Welch Allyn Inc.

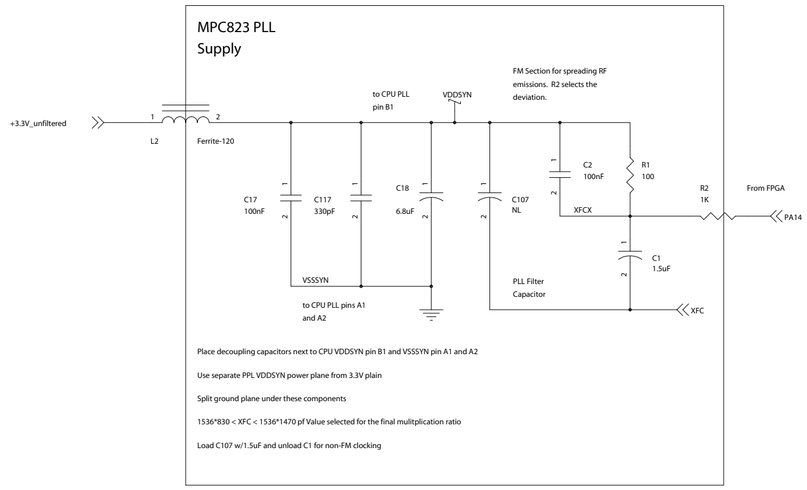
Schematic: 620005.dsn

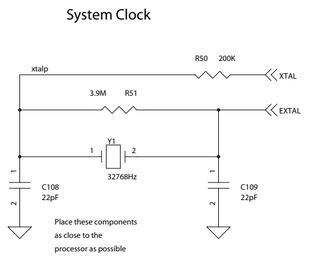
Title: PowerPC MPC823 CPU

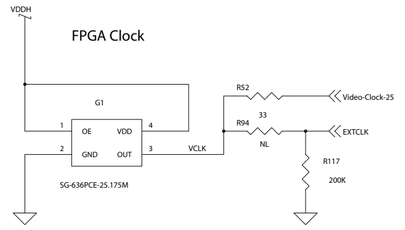
Size: C | Document Number: 620005 | Rev: D

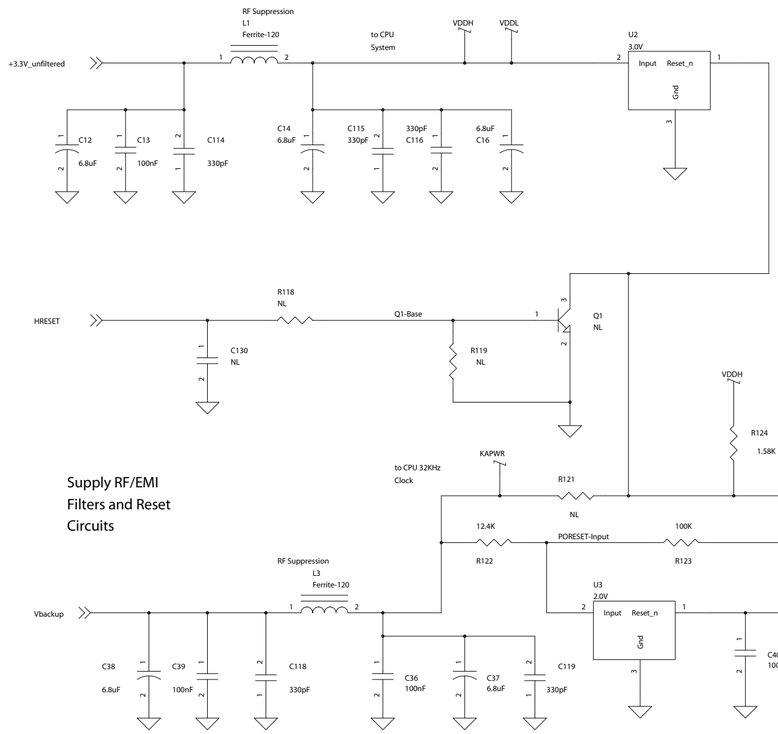
Date: Monday, August 05, 2002 Sheet 5 of 6

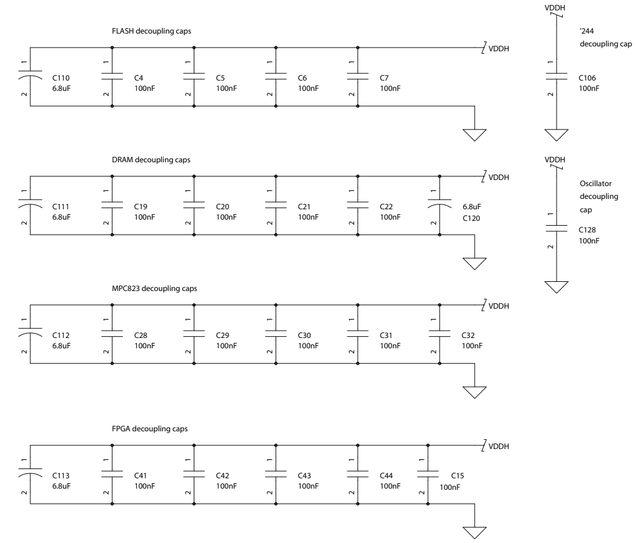
REV	Description	ECN/ECO	Init	Date	Ckd
A	Release to Production	5-39173	JAC	3/18/99	LPP
B	Component change for frequency modulation	5-39353	JJC	4/15/99	ZIP
C	Change Reset IC U3, No Load C40	5-39830	LPP	6/24/99	LPP
D	Upgrade to larger SDRAM	5-44759 LPP	6/20/02 JK		











	Initial	Date
Drawn	Jim Belesiu	Mar 5, 1999
Designed	Jim Belesiu	Mar 5, 1999
Checked	L. Phillips	3/19/99
Approved	Z. Psenicnik	3/19/99
Release For Production	J. Bello	3/19/99

Welch Allyn Inc.

Schematic: 620005.dsn

Title: Power Distribution, Clocks and Reset

Size: C | Document Number: 620005 | Rev: D

Date: Monday, August 05, 2002 Sheet 6 of 6

Figure D-12. Power distribution.

REV	Description	ECN/ECO	Init	Date	Ckd
A	Release to Production	5-39251	JAC	3/23/99	LPP
B	No Load D16	5-39485	LPP	4/28/99	LPP
C	D13 to Low Profile, RS1 to 316	5-39994	LPP	7/23/99	

Break-Away PCB Section

Flag Pole Area

Trend-sw — SW9 — Trend

Lead-Select-sw — SW11 — Lead Select

Print-sw — SW13 — Print

R65 1.21K, R66 1.21K, R67 1.21K, R68 1.21K

ACLED-1, ACLED-2

D1, D2 5x5 Green

AC-On-x — AC On LEDs

FP-Common

ACON-LED

On/Off-sw

Clock1

Key-data-b

Keyboard Circuits

On/Off-sw, Key-Clock-b, Key-Latch-b, Key-Data-b

Trend, Lead-Select, Print, Silence-Switch

Front Panel - A

Trend, Lead-Select, Print

J2A — flex-cable-5 — J2xA — flex-cable-5

Place capacitors by connector

VCC — C9 4.7uF — C27 4.7uF

J1 HEADER 7X2

Key-Clock, Key-Latch-n, Key-Data, LED-Data, LED-Enable, LED-Latch-n

TP182 — R71 100

U26 74HC244

u26-18, Key-Latch-b, LED-Data-b, u26-9, u26-7, LED-Latch-1, LED-Latch-2

RS1 316 — On-Led — D13 T1 (3mm) Green — On/Standby

R1 2.2K

I705144

LED_TP_Enable, LED_TP_Data_In, LED_TP_Clock, LED_TP_Latch, LED_TP_Data_Out

Front Panel - B

TP183 — R72 100 — Clock2

u19-out

R2 2.15K

U1A, U1B, U1C, U1D, U1E, U1F 74HC04

LED_TP_enable — TP2

LED_NIBP_enable — TP3

LED_SPO2_enable — TP4

NIBP LED Circuits

LED_NIBP_Enable, LED_NIBP_Data_In, LED_NIBP_Clock, LED_NIBP_Latch, LED_NIBP_Data_Out

Silence-LED

Front Panel - C

TP184 — R73 100 — Clock3

u13-out

I705124

LED_SpO2_Enable, LED_SpO2_Data_In, LED_SpO2_Clock, LED_SpO2_Latch

Front Panel - D

Silence-LED, Silence-Switch

J3A — flex-cable-5 — J3xA — flex-cable-5

Silence Button

Break-Away PCB Section

D10-Vcc — D10-C — D10 T1 (3mm) Red Silence LED

Sil-Sw-a — Sil-Sw-b — SW22 Silence Switch SW28

Place one tantalum cap near each seven segment LED group

C1, C8, C10, C11, C28 4.7uF

Place one ceramic cap near each IC

C2, C3, C4, C5, C6, C7, C12, C13, C14, C15, C16, C17, C18, C19, C20, C21, C22, C23, C24, C25, C26 0.1uF

9 8 7 6 / 10 5 / 1 2 3 4

Pull-up Resistor Network Detail

	Initial	Date
Drawn	Jim Belesiu	3/15/99
Designed	Jim Belesiu	3/15/99
Checked	L. Phillips	3/24/99
Approved	Z. Psenicnik	3/24/99
Release For Production	J. Bello	3/24/99

Welch Allyn Inc.

Schematic:

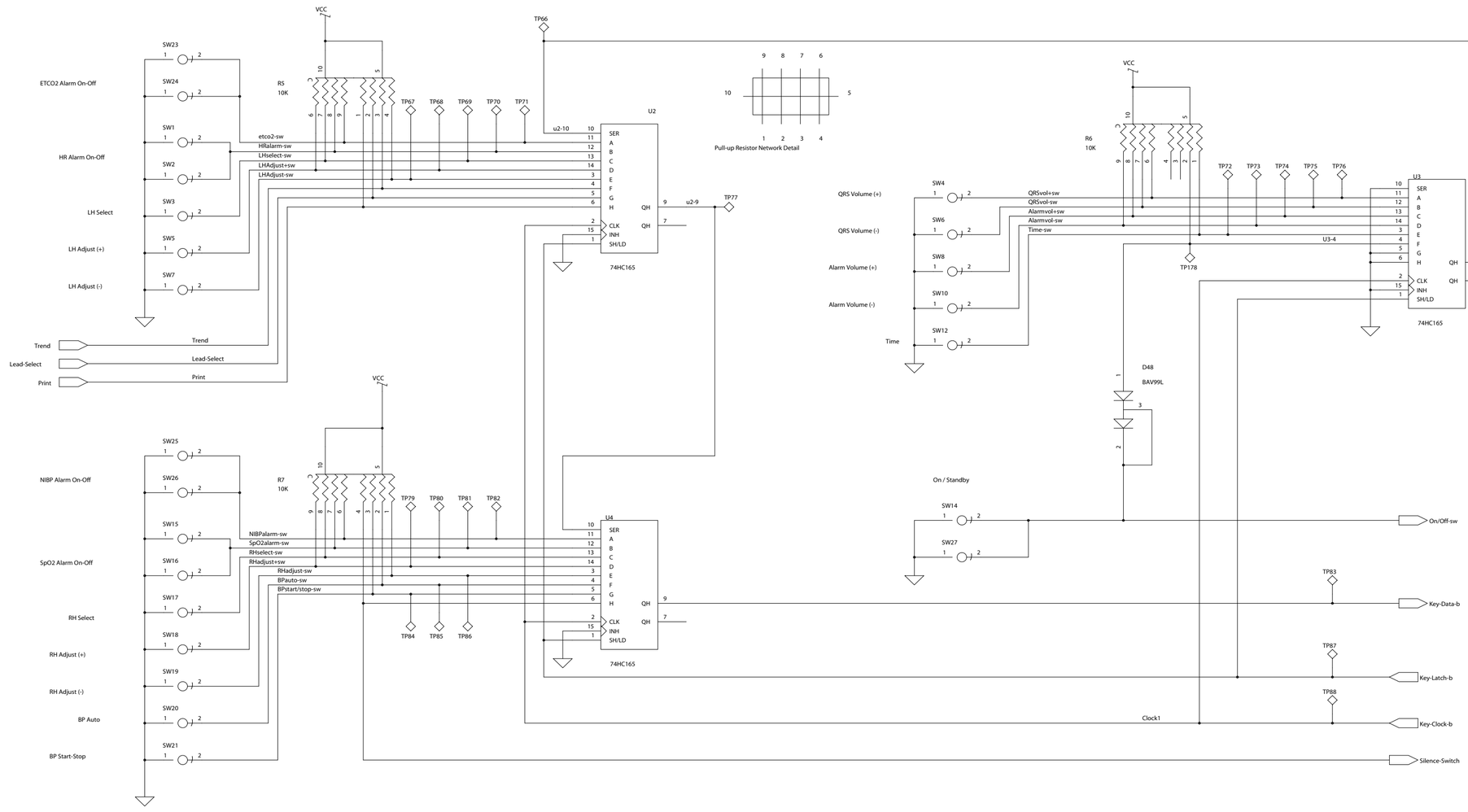
Title: Front Panel Display Board

Size: C — Document Number: 620008 — Rev: C

Date: Friday, July 23, 1999 — Sheet 1 of 5

Figure D-13. Front panel display.

REV	Description	ECN/ECO	Init	Date	Ckd
A	Release to Production	5-39251	JAC	3/23/99	LPP
B	No Load D16	5-39485	LPP	4/28/99	LPP
C	D13 to Low Profile, R51 to 316	5-39994	LPP	7/23/99	



	Initial	Date
Drawn	Jim Belesiu	3/15/99
Designed	Jim Belesiu	3/15/99
Checked	L. Phillips	3/23/99
Approved	Z. Psenicnik	3/23/99
Release For Production	J. Bello	3/23/99

Welch Allyn Inc.

Schematic: 620008.dsn

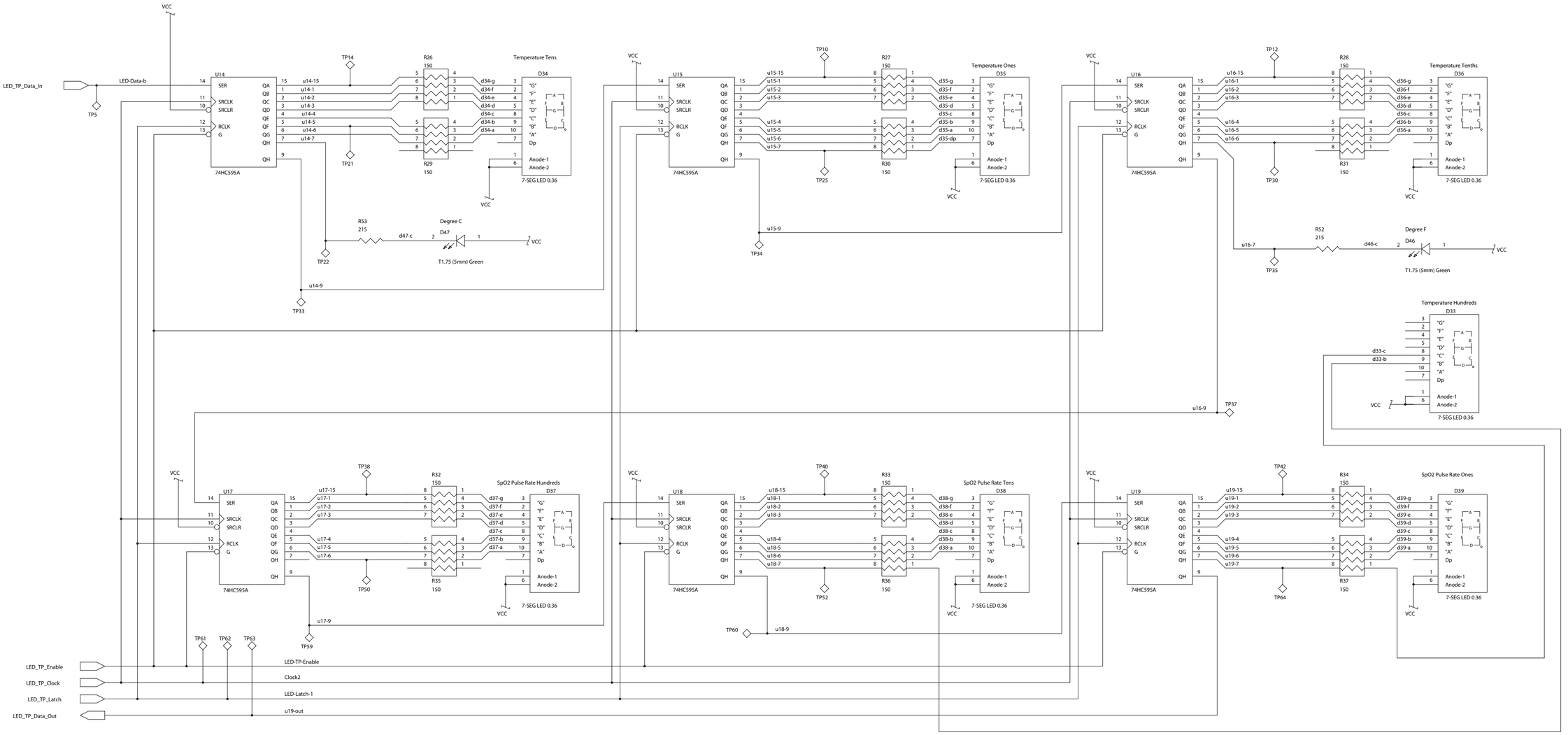
Title: Keyboard Scanner

Size: C | Document Number: 620008 | Rev: 6

Date: Friday, July 23, 1999 | Sheet 2 of 5

Figure D-14. Key board scanner.

REV	Description	ECN/ECO	Init	Date	Ckd
A	Release to Production	5-39251	JAC	3/23/99	LPP
B	No Load D16	5-39485	LPP	4/28/99	LPP
C	D13 to Low Profile, RS1 to 316	5-39994	LPP	7/23/99	



	Initial	Date
Drawn	Jim Belesiu	3/15/99
Designed	Jim Belesiu	3/15/99
Checked	L. Phillips	3/24/99
Approved	Z. Psenicnik	3/24/99
Release For Production	J. Bello	3/24/99

Welch Allyn Inc.

Schematic: 620008.dsn

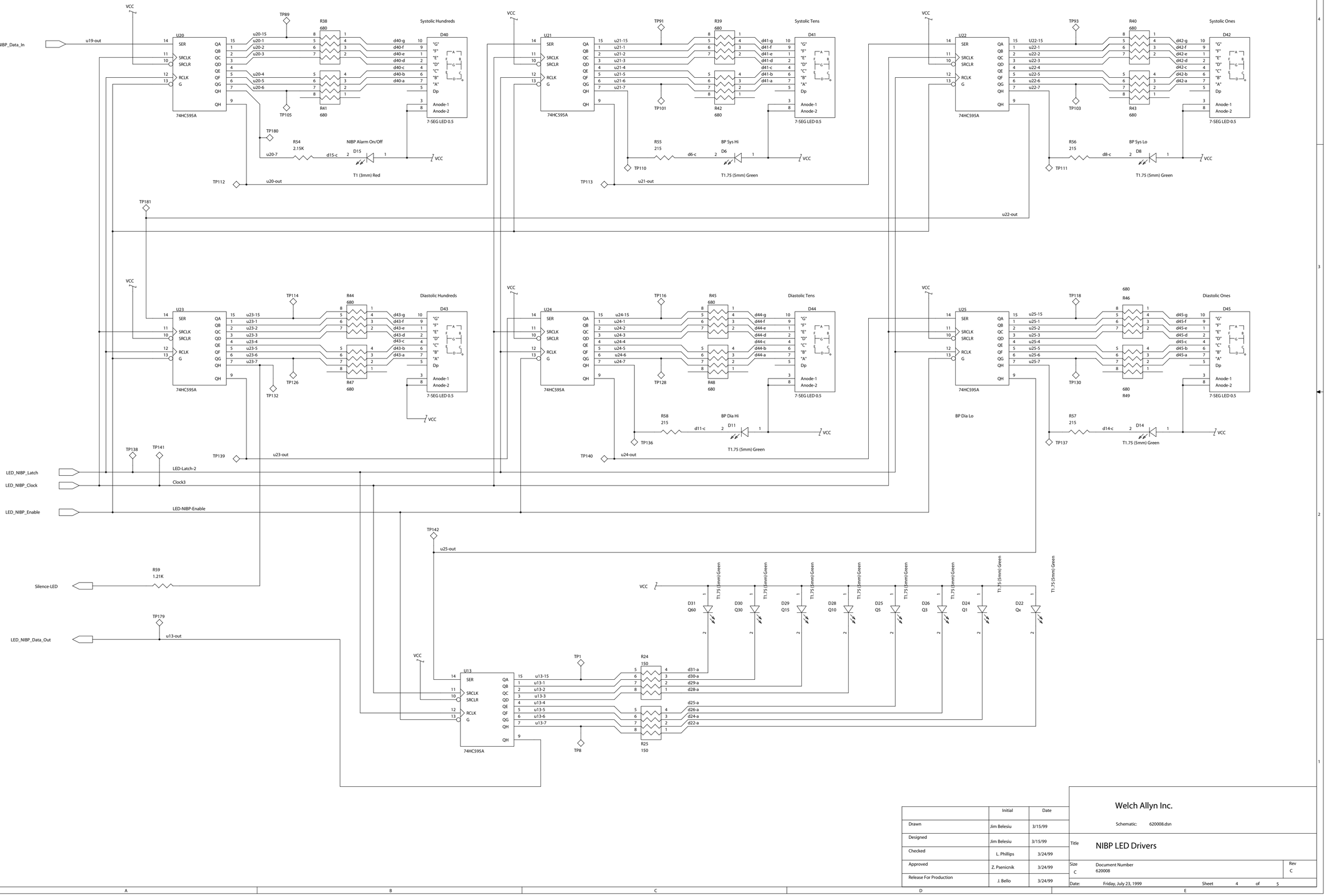
Title: Temp/Pulse LED Drivers

Size: C | Document Number: 620008 | Rev: C

Date: Friday, July 23, 1999 | Sheet 3 of 5

Figure D-15. Temp/pulse LED drivers.

REV	Description	ECN/ECO	Init	Date	Ckd
A	Release to Production	5.-39251	JAC	3/23/99	LPP
B	No Load D16	5-39485	LPP	4/28/99	LPP
C	D13 to Low Profile, RS1 to 316	5-39994	LPP	7/23/99	



	Initial	Date
Drawn	Jim Belesiu	3/15/99
Designed	Jim Belesiu	3/15/99
Checked	L. Phillips	3/24/99
Approved	Z. Psenicnik	3/24/99
Release For Production	J. Bello	3/24/99

Welch Allyn Inc.

Schematic: 620008.dsn

Title: NIBP LED Drivers

Size: C | Document Number: 620008 | Rev: C

Date: Friday, July 23, 1999 | Sheet 4 of 5

Figure D-16. NIBP LED drivers.

REV	Description	ECN/ECO	Init	Date	Ckd
A	Release to Production	5-39251	JAC	3/23/99	LPP
B	No Load D16	5-39485	LPP	4/28/99	LPP
C	D13 to Low Profile, RS1 to 316	5-39994	LPP	7/23/99	

LED_SpO2_Data_In
u13-out
U12
74HC595A
SpO2 Bargraph
D27
10 LED Bargraph
TP143
TP149
R21 680
R23 680
u12-out
TP177
TP151
TP152
R69 681
R70 681
D7 T1 (3mm) Red
HR Alarm On/Off
D9 T1 (3mm) Red
ETCO2 Alarm On/Off
D12 T1 (3mm) Red
SpO2 Alarm On/Off
d7-c
d9-c
d12-c
U5
TP162
R62 2.2K
SpO2 % Hundreds
D3
7-SEG LED 0.5
TP175
R63 215
D16
SpO2 Hi
No Load
TP172
R64 215
D18
SpO2 Lo
T1.75 (5mm) Green
TP174
U6
TP153
R9 680
SpO2 % Tens
D4
TP168
R12 680
TP176
U7
TP155
R10 680
SpO2 % Ones
D5
TP170
R13 680
u7-out
TP173
LED_SpO2_Clock
Clock1
LED_SpO2_Latch
LED-Latch-2
LED_SpO2_Enable
LED-SPO2-Enable

	Initial	Date
Drawn	Jim Belesiu	3/15/99
Designed	Jim Belesiu	3/15/99
Checked	L. Phillips	3/24/99
Approved	Z. Psenicnik	3/24/99
Release For Production	J. Bello	3/24/99

Welch Allyn Inc.

Schematic: 620008.dsn

Title: SPO2 LED Drivers

Size: C | Document Number: 620008 | Rev: C

Date: Friday, July 23, 1999 | Sheet 5 of 5

Figure D-17. SpO_2 LED drivers.

Width Coil (L3) inductance range changed

REV	Description	ECN/ECO	Init	Date	Ckd
A	Release to Production	5-39097	JAC	3/9/99	LPP
B	Modify Video Amplifier Reduce RF Emissions	5-39339	JJC	4/15/99	ZIP
C	Increase Flex Cable to 3 inches	5-39831	LPP	6/24/99	LPP
D	Width Coil Inductance (L3) increased	5-40006	LPP	7/23/99	

Vertical Amplifier

Vertical Sync, 750uSec, 16.7mSec

Ramp Generator: R1 1K, R2 7.50K, C3 .047uF, C4 .047uF, U1A TLC272, U2A MC34072, C2 100pF, C1 .1uF, R3 23.7K, R43 5.11K, R52 1.96K, U4A 74HCT04, D6 1N4148, D1 1N4148

Size Adjust: Q1 MPSW01A, Q2 MPS651A, Q3 MPSW01A, Q4 MPS51A, C5 22uF, R12 562, R13 169, R14 562, R15 38.3, R16 10, R17 10, R18 562, R19 562, R20 169, R21 562, vadj

U2B MC34072, R22 10K, R23 10K, u2.7, u2.6

To Yoke: J2 CON5, vert-, vert+, j2-3, hor+, hor-, R31 10K

To Main Board: J1 CON6, Vsync, Hsync, Video

U3 MC78L05ACP, C6 .047uF, C7 .047uF

Zero Adjust: U1B TLC272, R4 10K, R5 42.2K, R6 41.2K, R7 41.2K, R8 41.2K, R9 1.47K, R10 1K, R11 1.96K, vcadj

Horizontal Amplifier

Horizontal Sync, 5.5uSec, 31.7uSec

U4B 74HCT04, C22 .022uF, R24 10K, R25 215, R26 1K, R27 10, Q5 2N3904, Q6 IRF640, R50 1.96K

C8 .022uF, C9 6.8uF, L2 15uH, L3 15- 35uH, hlin, hwide

T1 CRT-FBT, To CRT Anode

Boost, C11 1000uF, D2 MUR120, L1 47uH, C10 1000uF, +12filt, +B, Hor

Grid Voltages

D3 1N4935, D4 1N4935, D5 1N4937, C12 22uF, C13 22uF, C14 .01uF, C15 .01uF, C16 .01uF, C17 .01uF

Brightness Adjust: R29 100K, R28 19.6K

Focus Adjust: R30 100K, R32 2.5Meg, Focus

Video Amplifier

R36 1.96K, R37 1.96K, C19 .01uF, C18 .047uF, RS1 19.6K, U4E 74HCT04, R48 100, Q7 BS170, Q8 2N3904, D7 1N4148, R41 681, C20 No Load

6 Position flat ribbon cable

Connects Main CRT to CRT socket Board

Break Away CRT socket Board

1/2W Carbon Comp

J3 Flex6, J3x Flex6, J4 CRT-Socket

R44 330, R45 330, R46 47K, R47 47K

tube.g1, tube.vd, tube.12V, tube.gnd, tube.g1, tube.g2, tube.g4

Unused

U4C 74HCT04, U4D 74HCT04, U4F 74HCT04

	Initial	Date
Drawn	Rick Myers	Mar 4 1999
Designed	Rick Myers	Mar 4 1999
Checked	L.Phillips	3/9/99
Approved	Z.Psenicnik	3/9/99
Release For Production	J.Bello	3/9/99

Welch Allyn Inc.

Schematic: 620011.dsn

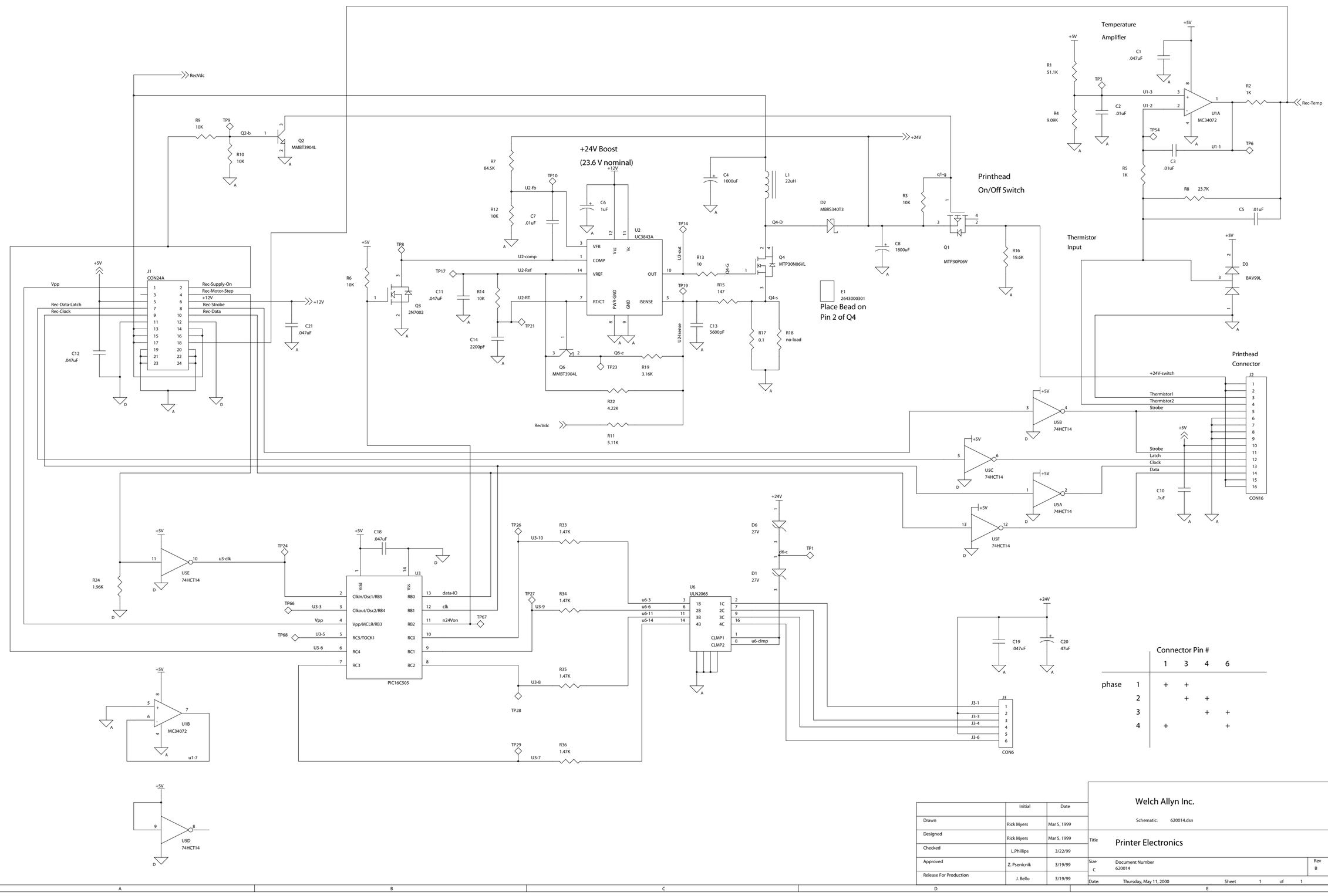
Title: CRT Deflection Board

Size: C | Document Number: 620011 | Rev: D

Date: Friday, July 23, 1999 | Sheet 1 of 1

Figure D-18. CRT deflection board.

REV	Description	ECN/ECO	Init	Date	Ckd
A	Release to Production	5-39179	JAC	3/18/99	LPP
B	Add EMI bead to Q4, improve radiated emissions	5-41395	JB	5/9/00	



Connector Pin #		1	3	4	6
phase	1	+	+		
	2		+	+	
	3			+	+
	4	+			+

	Initial	Date
Drawn	Rick Myers	Mar 5, 1999
Designed	Rick Myers	Mar 5, 1999
Checked	L.Phillips	3/22/99
Approved	Z. Psenicnik	3/19/99
Release For Production	J. Bello	3/19/99

Welch Allyn Inc.

Schematic: 620014.dsn

Title: Printer Electronics

Size: C | Document Number: 620014 | Rev: B

Date: Thursday, May 11, 2000 | Sheet 1 of 1

Figure D-19. Printer electronics.

REV	Description	ECN/ECO	Init	Date	Ckd
A	Release to Production	5-39121	JAC	3/15/99	LPP
B	See ECN worksheet	5-39455	LPP	4/27/99	LPP
D	Improvements for ESD, RFI, and Fast Transients, Correct Resolution Diff Amp Topology	5-39821	LPP	6/24/99	LPP
E	Mods to U2 clock line, Resp gain amp, ECG supply and NVRAM pullup	5-39936	LPP	7/9/99	LPP
F	Buffer for ETCO2, Nurse call relay Modify RLD to reduce V-Lead noise Improve ESU rejection	5-44461	LPP	3/26/02	JK
G	SpO2 bypass cap, RS232 PS mods 4KV nurse call relay,Improve CMRR for Resp Topology	5-44857	LPP	7/18/02	JK

	Initial	Date
Drawn	Rick Myers	Mar 5, 1999
Designed	Rick Myers	Mar 5, 1999
Checked	L. Phillips	3/16/99
Approved	Z. Psenicnik	3/16/99
Release For Production	J. Bello	3/16/99

Welch Allyn Inc.

Schematic: 620017.dsn

Title: Main Board - Model 220

Size: C | Document Number: 620017 | Rev: G

Date: Monday, August 05, 2002 | Sheet 1 of 8

Figure D-20. Model 220 main board.

REV	Description	ECN/ECO	Init	Date	Ckd
A	Release to Production	S-39121	JAC	3/15/99	LPP
B	See ECN worksheet	S-39455	LPP	4/27/99	LPP
D	Improvements for ESD, RFI, and Fast Transients, Correct Respiration Diff Amp Topology	S-39821	LPP	6/24/99	LPP
E	Mods to U2 clock line, Resp gain amp, ECG supply and NVRAM pullup	S-39936	LPP	7/9/99	LPP
F	Buffer for ETCO2, Nurse call relay Modify RLD to reduce V-Lead noise Improve ESU rejection	S-44461	LPP	3/26/02	JK
G	SpO2 bypass cap, RS232 PS mods 4KV nurse call relay,Improve CMRR for Resp Topology	S-44857	LPP	7/18/02	JK

Primary Transducer

0mmHG = 0.5V

300mmHG = 4.0V

Zero Adjust

+/-20mmHg range

PWM D/A

76.8KHz

Safety Transducer

Zero Offset

A/D Mux

Over Pressure Fault Circuit

NIBP PWM A/D Converter

PWM A/D Converter

	Initial	Date
Drawn	Rick Myers	Mar 5, 1999
Designed	Rick Myers	Mar 5, 1999
Checked	L. Phillips	3/16/99
Approved	Z. Psenicnik	3/16/99
Release For Production	J. Bello	3/16/99

Welch Allyn Inc.

Schematic: 620017.dsn

Title: NIBP ELECTRONICS

Size: C | Document Number: 620017 | Rev: G

Date: Monday, August 05, 2002 | Sheet 2 of 8

Figure D-21. 210/220 NIBP electronics.

REV	Description	ECN/ECO	Init	Date	Ckd
A	Release to Production	5-39121	JAC	3/15/99	LPP
B	See ECN worksheet	5-39455	LPP	4/27/99	LPP
D	Improvements for ESD, RFI, and Fast Transients, Correct	5-39821	LPP	6/24/99	LPP
E	Respiration Diff-Amp Topology Mods to U2 clock line, Resp gain amp, ECG supply and NVRAM pullup	5-39936	LPP	7/9/99	LPP
F	Buffer for ETCO2, Nurse call relay Modify RLD to reduce V-Lead noise Improve ESU rejection	5-44461	LPP	3/26/02	JK
G	SpO2 bypass cap, RS232 PS mods 4KV nurse call relay, Improve CMR for Resp Topology	5-44857	LPP	7/18/02	JK

	Initial	Date
Drawn	Rick Myers	Mar 5, 1999
Designed	Rick Myers	Mar 5, 1999
Checked	L. Phillips	3/16/99
Approved	Z. Psenicnik	3/16/99
Release For Production	J. Bello	3/16/99

Welch Allyn Inc.

Schematic: 620017.dsn

Title: DC/DC Power Supplies

Size: C | Document Number: 620017 | Rev: G

Date: Monday, November 04, 2002 | Sheet 3 of 8

Figure D-22. DC/DC power supply.

REV	Description	ECN/ECO	Init	Date	Ckd
A	Release to Production	5-39121	JAC	3/15/99	LPP
B	See ECN worksheet	5-39455	LPP	4/27/99	LPP
D	Improvements for ESD, RFI, and Fast Transients, Correct Respiration Diff Amp Topology	5-39821	LPP	6/24/99	LPP
E	Mods to U2 clock line, Resp gain amp, ECG supply and NVRAM pullup	5-39936	LPP	7/9/99	LPP
F	Buffer for ETCO2, Nurse call relay Modify RLD to reduce V-Lead noise Improve ESU rejection	5-44461	LPP	3/26/02	JK
G	SpO2 bypass cap, RS232 PS mods 4KV nurse call relay, Improve CMR for Resp Toplogy	5-44857	LPP	7/18/02	JK

	Initial	Date
Drawn	Rick Myers	Mar 5, 1999
Designed	Rick Myers	Mar 5, 1999
Checked	L. Phillips	3/16/99
Approved	Z. Psenicnik	3/16/99
Release For Production	J. Bello	3/16/99

Welch Allyn Inc.

Schematic: 620017.dsn

Title: Power Isolation and SpO2 Interface

Size: C | Document Number: 620017 | Rev: G

Date: Monday, August 05, 2002 | Sheet 4 of 8

Figure D-23. Power isolation/SpO_2 interface.

REV	Description	ECN/ECO	Init	Date	Ckd
A	Release to Production	5-39121	JAC	3/15/99	LPP
B	See ECN worksheet	5-39455	LPP	4/27/99	LPP
D	Improvements for ESD, RFI, and Fast Transients, Correct Respiration Diff-Amp Topology	5-39821	LPP	6/24/99	LPP
E	Mods to U2 clock line, Resp gain amp, ECG supply and NVRAM pullup	5-39936	LPP	7/9/99	LPP
F	Buffer for ETCO2, Nurse call relay Modify RLD to reduce V-Lead noise Improve ESU rejection	5-44461	LPP	3/26/02	JK
G	SpO2 bypass cap, RS232 PS mods 4KV nurse call relay, Improve CMR for Resp Toplogy	5-44857	LPP	7/18/02	JK

Defib Protect
Clamp voltage for Temp
and Resp circuits

ESU filter

Input Buffers
Gain = 9.26

A/D Inputs
Leads Off

Lead Select

Wilson
Network

Diff Amp
Gain = 1

High Pass (0.05Hz or 0.5Hz)
Low Pass (150Hz)

Gain Stage
Gain = 74

RLD Amp

V-Lead Defib Protect,
Diodes internal to U504
protect other inputs.

No Load,
Allows RLD switch
to V-Lead, not used.

	Initial	Date
Drawn	Rick Myers	Mar 5, 1999
Designed	Rick Myers	Mar 5, 1999
Checked	L. Phillips	3/16/99
Approved	Z. Psenicnik	3/16/99
Release For Production	J. Bello	3/16/99

Welch Allyn Inc.

Schematic: 620017.dsn

Title: ECG Amp

Size: C | Document Number: 620017 | Rev: G

Date: Monday, August 05, 2002 | Sheet 5 of 8

Figure D-24. 210/220 ECG amp.

REV	Description	ECN/ECO	Init	Date	Ckd
A	Release to Production	5-39121	JAC	3/15/99	LPP
B	See ECN worksheet Improvements for ESD, RFI,	5-39455	LPP	4/27/99	LPP
D	and Fast Transients, Correct Respiration Diff-Amp Topology Mods to U2 clock line, Resp	5-39821	LPP	6/24/99	LPP
E	gain amp, ECG supply and NVRAM pullup Buffer for ETCO2, Nurse call relay	5-39936	LPP	7/9/99	LPP
F	Modify RLD to reduce V-Lead noise Improve ESU injection SpO2 bypass cap, RS232 PS mods	5-44461	LPP	3/26/02	JK
G	48V nurse call relay. Improve CMR for Resp Toplogy	5-44857	LPP	7/18/02	JK

Isolation Barrier

Temperature Amplifier

Temperature Thermistor

A/D Mux

PWM A/D Converter

	Initial	Date
Drawn	Rick Myers	Mar 5, 1999
Designed	Rick Myers	Mar 5, 1999
Checked	L. Phillips	3/16/99
Approved	Z. Psenicnik	3/16/99
Release For Production	J. Bello	3/16/99

Welch Allyn Inc.

Schematic: 620017.dsn

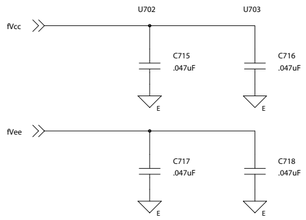
Title: ECG A/D and Interface

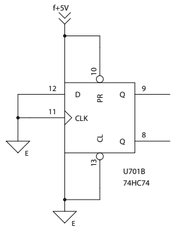
Size: C | Document Number: 620017 | Rev: G

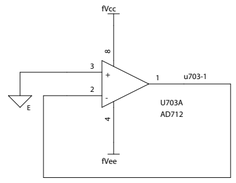
Date: Monday, November 04, 2002 | Sheet 6 of 8

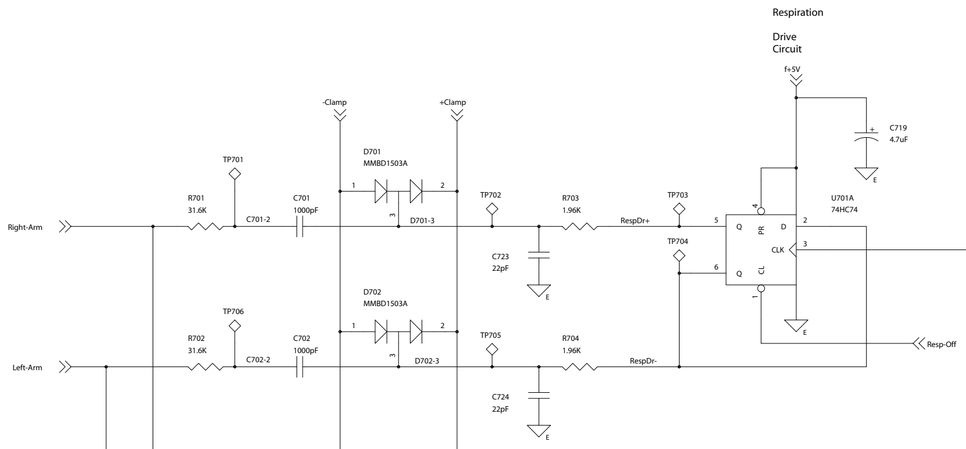
Figure D-25. 210/220 ECG A/D interface.

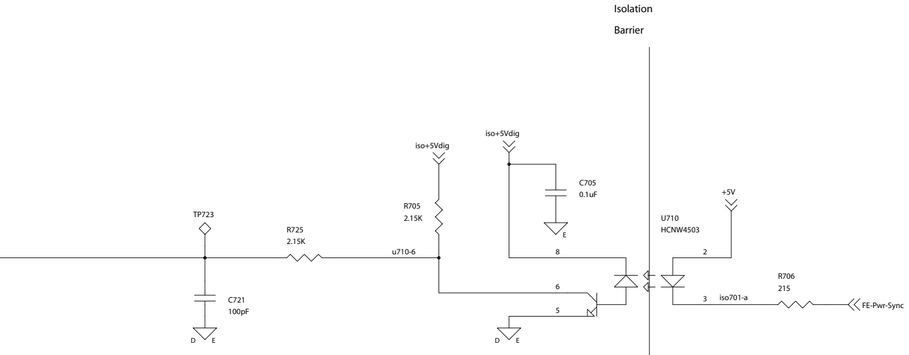
REV	Description	ECN/ECO	Init	Date	Ckd
A	Release to Production	5-39121	JAC	3/15/99	LPP
B	See ECN worksheet	5-39455	LPP	4/27/99	LPP
D	Improvements for ESD, RFI, and Fast Transients, Correct Respiration Diff-Amp Topology	5-39821	LPP	6/24/99	LPP
E	Mods to U2 clock line, Resp gain amp, ECG supply and NVRAM pullup	5-39936	LPP	7/9/99	LPP
F	Buffer for ETCO2, Nurse call relay Modify RLD to reduce V-Lead noise Improve ESU rejection	5-44461	LPP	3/26/02	JK
G	SpO2 bypass cap, RS232 PS mods 4KV nurse call relay;Improve CMRR for Resp Topology	5-44857	LPP	7/18/02	JK

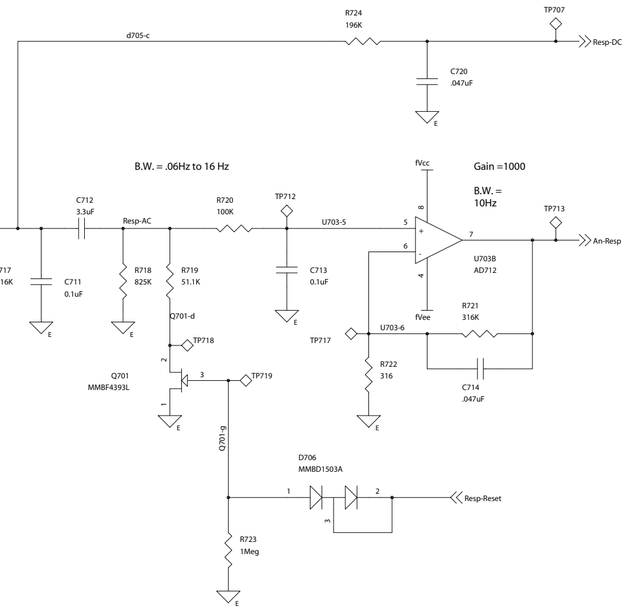


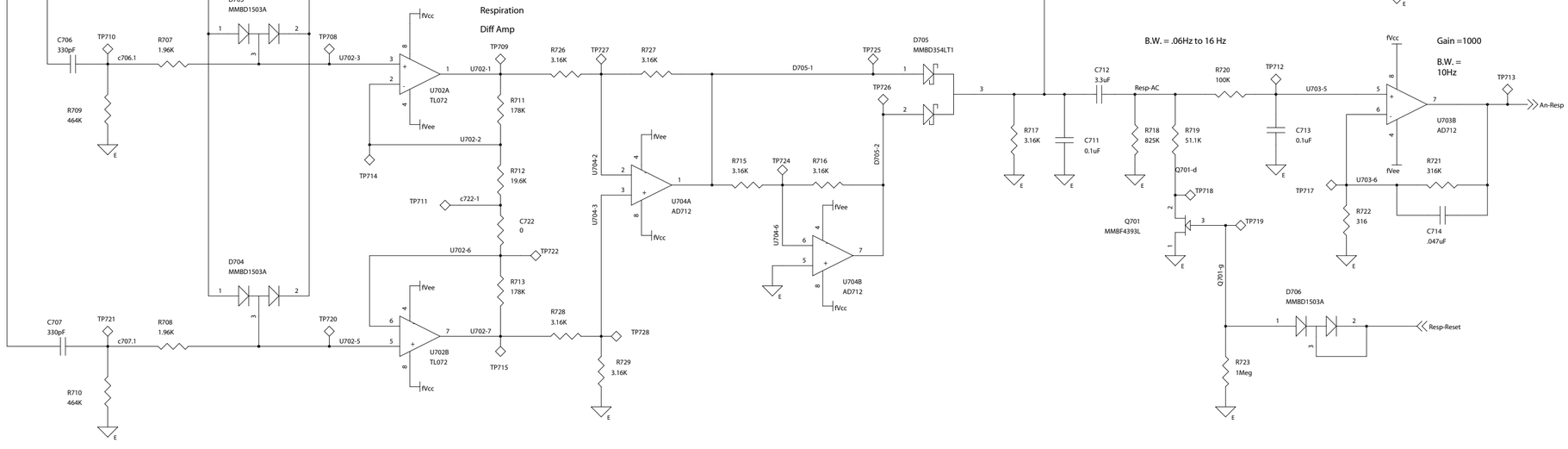












	Initial	Date
Drawn	Rick Myers	Mar 5, 1999
Designed	Rick Myers	Mar 5, 1999
Checked	L. Phillips	3/16/99
Approved	Z. Psenicnik	3/16/99
Release For Production	J. Bello	3/16/99

Welch Allyn Inc.

Schematic: 620017.dsn

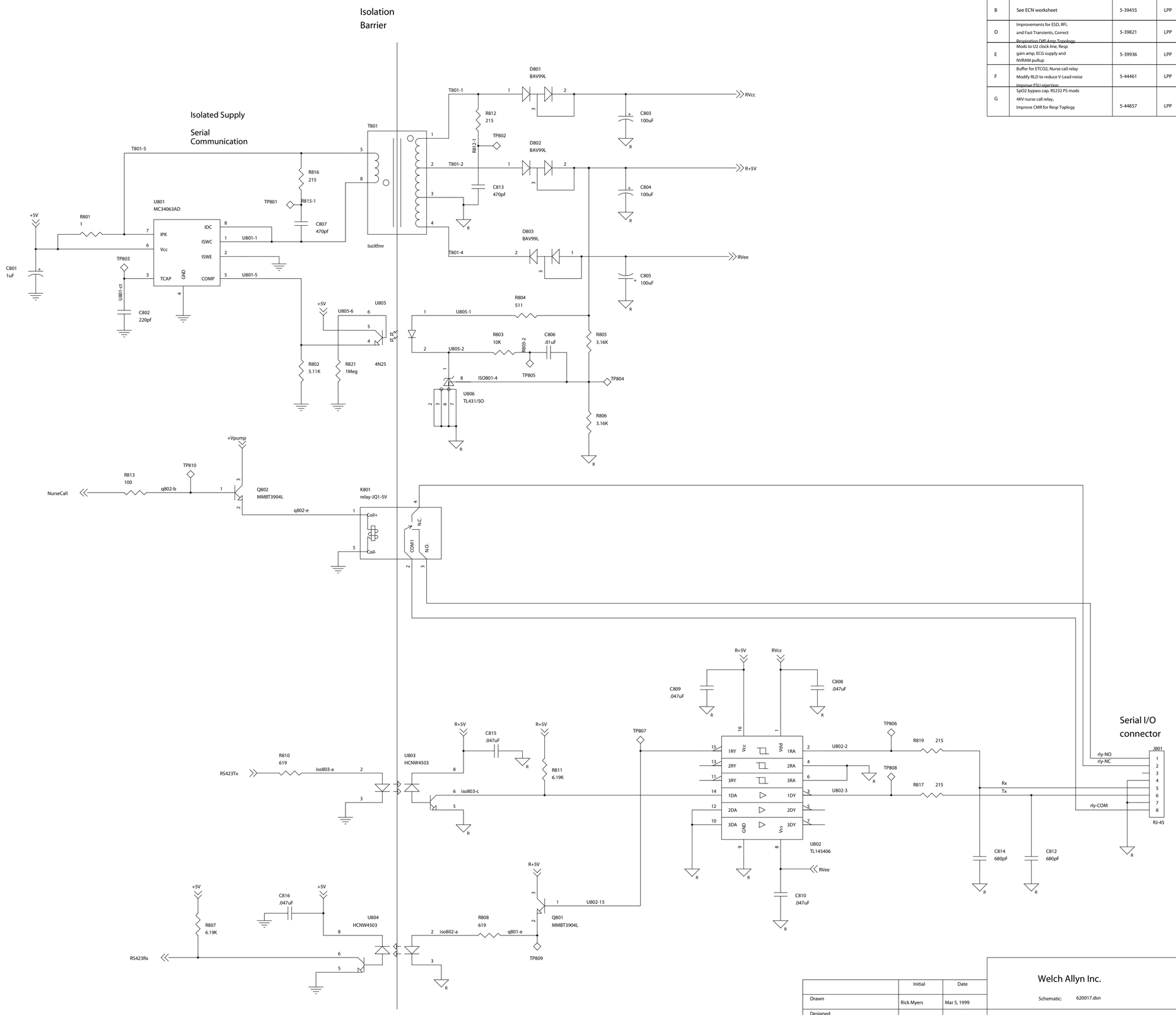
Title: Respiration

Size: C | Document Number: 620017 | Rev: G

Date: Monday, August 05, 2002 | Sheet 7 of 8

Figure D-26. 210/220 Respiration circuit.

REV	Description	ECN/ECO	Init	Date	Ckd
A	Release to Production	5-39121	JAC	3/15/99	LPP
B	See ECN worksheet	5-39455	LPP	4/27/99	LPP
D	Improvements for ESD, RFI, and Fast Transients, Correct Respiration Diff-Amp Topology	5-39821	LPP	6/24/99	LPP
E	Mods to U2 clock line, Resp gain amp, ECG supply and NVRAM pullup	5-39936	LPP	7/9/99	LPP
F	Buffer for ETCO2, Nurse call relay Modify RLD to reduce V-Lead noise Improve ESU rejection	5-44461	LPP	3/26/02	JK
G	SpO2 bypass cap, RS232 PS mods 4KV nurse call relay, Improve CMR for Resp Toplogy	5-44857	LPP	7/18/02	JK



	Initial	Date
Drawn	Rick Myers	Mar 5, 1999
Designed	Rick Myers	Mar 5, 1999
Checked	L. Phillips	3/16/99
Approved	Z. Psenicnik	3/16/99
Release For Production	J. Bello	3/16/99

Welch Allyn Inc.

Schematic: 620017.dsn

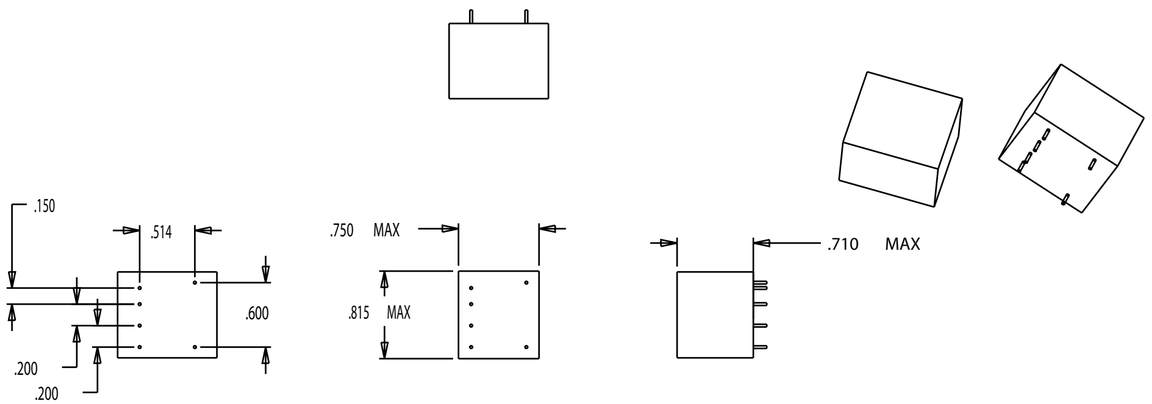
Title: Serial Communication

Size: C | Document Number: 620017 | Rev: G

Date: Monday, August 05, 2002 | Sheet 8 of 8

Figure D-27. 210/220 serial communication.

REV	DESCRIPTION	ECN/ECO	INIT	DATE	CKD
A	RELEASE TO PROD. ENG.	5-39342	JRS	4/08/99	T.W.
B	NOTE 5 WAS "INDUCTANCE : 380 uH p 10%"	5-43326	RLB	10-12-01	T.W.



PCB
HOLE PATTERN

NOTES:

1. MANUFACTURER: ZMAN MAGNETIC
BEAVERTON OREGON

2. TRANSFORMER MUST MEET UL CONSTRUCTION TECHNIQUES.

3. LABELING: THE TRANSFORMER SHALL BE LABELED, AND INCLUDE THE FOLLOWING:

- MANUFACTURER'S NAME
- WELLCH ALLYN PART NUMBER I.E. 620020
- DATE CODE: YYWW (OR APPROVED ACCEPTABLE FORM)

4. SCHEMATIC AS NOTED.

5. SPECIFICATIONS:

ISOLATION CAPACITANCE: < 7.5 pF
VOLTAGE BREAKDOWN : > 8 KV DC
INPUT : +12 V DC
OUTPUT 1 : +7.5 V þ 0.5 V @ 40 mA
OUTPUT 2 : +5 V @ 100 mA (REGULATED)
OUTPUT 3 : -7.5 V þ 0.5 V @ 40 mA

SWITCHING FREQUENCY : 76.8 kHZ
OPERATING MODE : DISCONTINUOUS

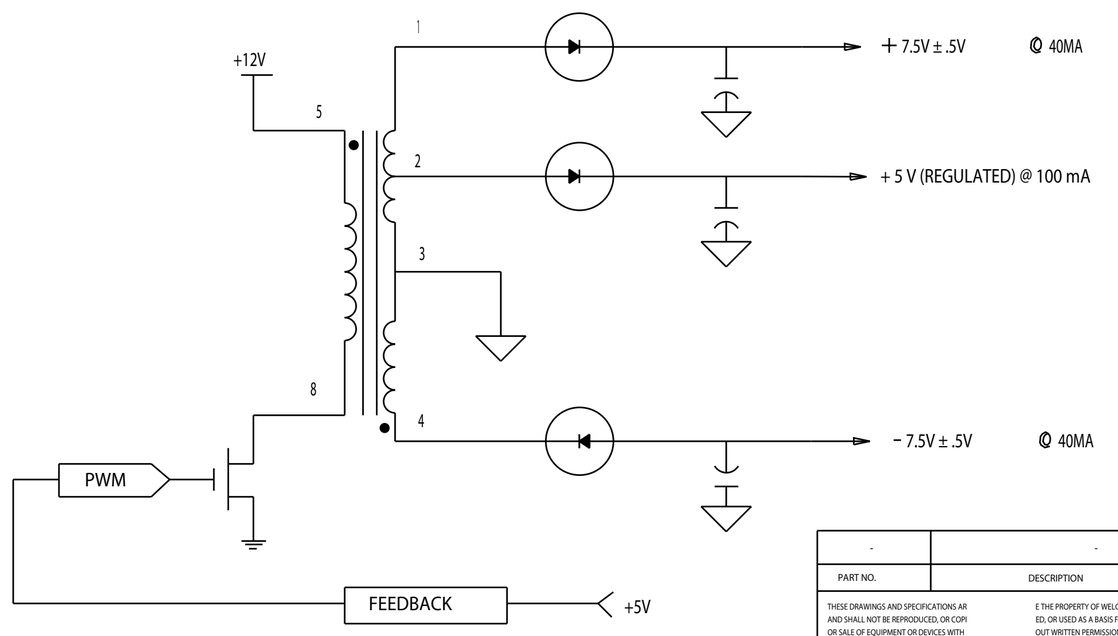
PRIMARY WINDING : PIN 5 TO PIN 8
INDUCTANCE : 135 uH þ 10%
RESISTANCE : 0.15 OHMS þ 15%
SECONDARY WINDING : PIN 1 TO PIN 4
INDUCTANCE : 380 uH +10%/-15%
RESISTANCE : 0.25 OHMS þ 15%

B

6. THE FOLLOWING TESTS TO BE PERFORMED ON 100% OF THE PARTS AND WRITTEN CERTIFICATION TO BE SUPPLIED WITH EACH LOT:

A. PRIMARY INDUCTANCE (PIN 5 TO PIN 8).
B. SECONDARY INDUCTANCE (PIN 1 TO PIN 4).
C. TURNS RATIOI 1-4 TO 5-8.
D. VOLTAGE BREAKDOWN.

7. PART TO BE A RECOGNIZED COMPONENT UNDER UL2601 OR EN60601.1 CONSTRUCTION.



CIRCUIT SCHEMATIC

-	-
PART NO.	DESCRIPTION

THESE DRAWINGS AND SPECIFICATIONS AR E THE PROPERTY OF WELCH ALLYN, INC. AND SHALL NOT BE REPRODUCED, OR COPI ED, OR USED AS A BASIS FOR MANUFACTU RE OR SALE OF EQUIPMENT OR DEVICES WITH OUT WRITTEN PERMISSION.

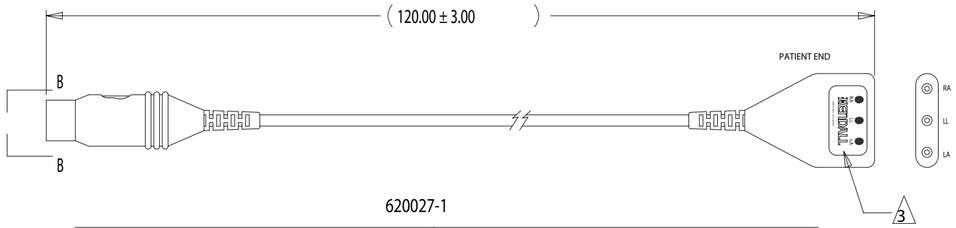
DRAWN WJM	DATE 01-Apr-99	Welch Allyn®
APPROVED ZIP	DATE 4/08/99	MATERIAL: -
REL TO PROD J. BELLO	DATE 4/08/99	FINISH: -
-	-	TITLE: TRANSFORMER ISOLATION
CAD SOFTWARE:	PROE	
TRANSLATED FROM:	ME10	

UNLESS OTHERWISE SPECIFIED
TOLERANCES DIMENSIONS ARE IN INCHES
.XX = ±.02
.XXX = ±.005
ANGLES ±2 °

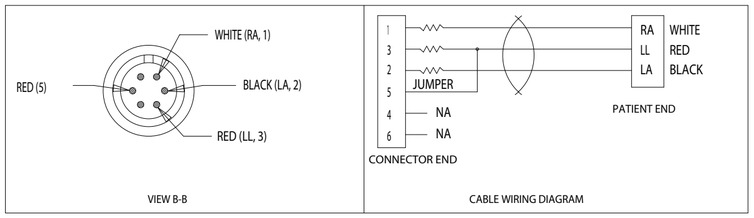
C	DRAWING NO. 620020	REV B
SCALE FULL	SHEET 1 of 1	

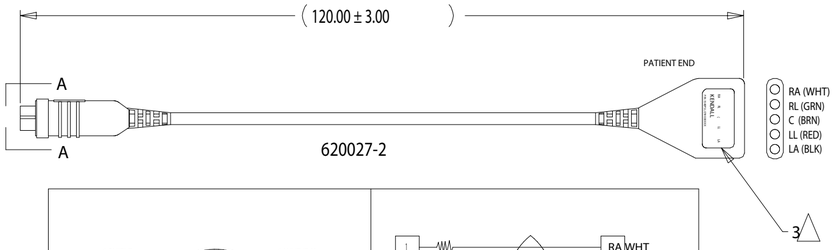
Figure D-28. 200/210/220 transformer isolation.

REV	DESCRIPTION	ECN/ECO	INIT	DATE	CKD
A	RELEASE TO PROD. ENG.	5-39391	JRS	4/16/99	T.W.
B	ADD 620027-3,-4 (IEC) CHANGE NOTES 3,4	5-39935	ASK	7-8-99	S.S.

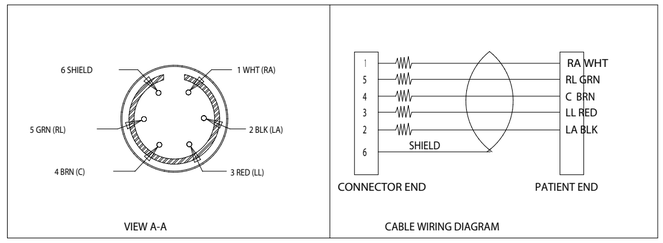


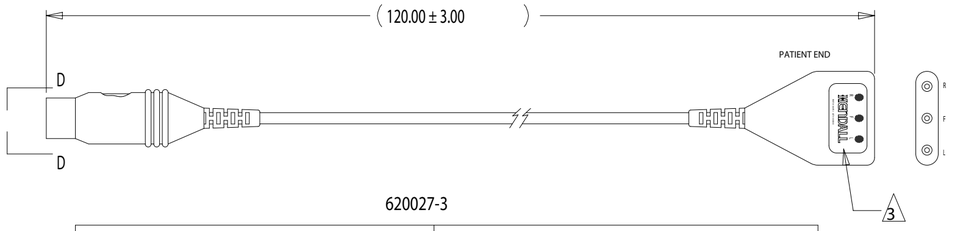
620027-1



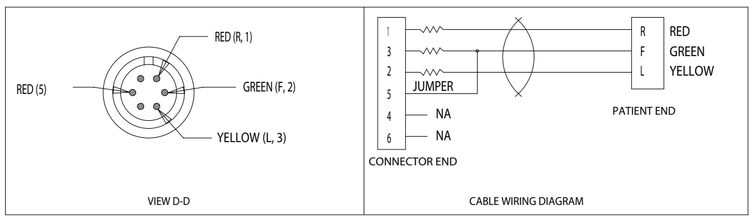


620027-2





620027-3



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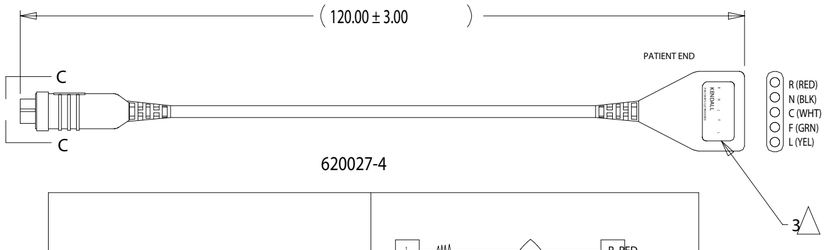
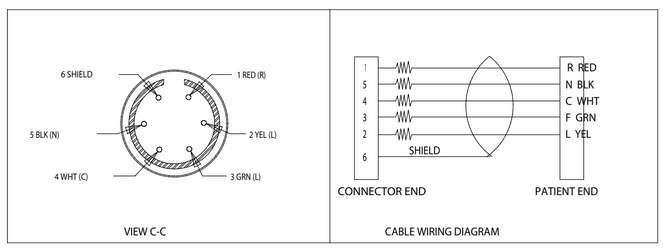
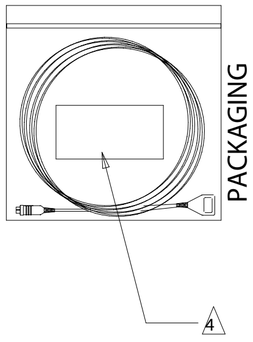


620027-4



B



	CATALOG P/N	REF P/N	DESCRIPTION	
620027-1	1340PS	MW02500	3-LEAD; DIN STYLE SAFETY PATIENT CABLE; COLOR CODE:W,R,BL	5
620027-2	1540PS	MW03775	5-LEAD; DIN STYLE SAFETY PATIENT CABLE; COLOR CODE:W,G,BR,R,BL	6
620027-3	1340PS-I		3-LEAD, DIN STYLE SAFETY PATIENT CABLE IEC COLOR CODE: R,G,Y	8
620027-4	1540PS-I		5-LEAD, DIN STYLE SAFETY PATIENT CABLE IEC COLOR CODE: R,B,W,G,Y	9

NOTES:

1. CONNECTOR AND TRUNK CABLE SHALL BE 414C GRAY
AND THE PATIENT END SHALL BE BLACK.

2. ELECTRICAL RESISTANCE SHALL BE BETWEEN 900 AND 1100 OHMS.

3. CABLE NAMEPLATE SHALL CONTAIN:
KENDALL
B PART NUMBER: SEE TABLE - CATALOG P/N
LOT NUMBER: XXXXXX

4. PACKAGING BAG LABEL SHALL CONTAIN:
KENDALL
B CATALOG NUMBER: SEE TABLE
PART NUMBER: SEE TABLE - REF P/N
DESCRIPTION: SEE TABLE
QUANTITY: 1 EACH
LOT NUMBER: XXXXXX

5. CHANNEL DESIGNATIONS: RA=WHITE, LL=RED, LA=BLACK;
WITH 1 K OHM RESISTORS;
WIRING PER ANSI/AAMI 1983 ECG CONNECTOR STANDARD;
(COMPLIANT WITH ANSI/AAMI EC53-1995 CABLE AND LEAD STANDARD)

6. CHANNEL DESIGNATIONS: RA=WHITE, RL= GREEN, C=BROWN;
LL=RED, LA=BLACK; WITH 1 K OHM RESISTORS;
WIRING PER ANSI/AAMI 1983 ECG CONNECTOR STANDARD;
(COMPLIANT WITH ANSI/AAMI EC53-1995 CABLE AND LEAD STANDARD)

7. CABLE MUST MEET THE PERFORMANCE STANDARD FOR ELECTRODE LEAD WIRES
AND PATIENT CABLES FOUND IN TITLE 21 CFR, PART 898

8. CHANNEL DESIGNATIONS: R=RED, F=GREEN, L=YELLOW;
B WITH 1 K OHM RESISTORS;
WIRING PER ANSI/AAMI 1983 ECG CONNECTOR STANDARD;
(COMPLIANT WITH ANSI/AAMI EC53-1995 CABLE AND LEAD STANDARD)

9. CHANNEL DESIGNATIONS: R=RED, N=BLACK, C=WHITE;
F=GREEN, L=YELLOW; WITH 1 K OHM RESISTORS;
B WIRING PER ANSI/AAMI 1983 ECG CONNECTOR STANDARD;
(COMPLIANT WITH ANSI/AAMI EC53-1995 CABLE AND LEAD STANDARD)

-	-
PART NO.	DESCRIPTION

THESE DRAWINGS AND SPECIFICATIONS AR E THE PROPERTY OF WELCH ALLYN, INC.
AND SHALL NOT BE REPRODUCED, OR COPI ED, OR USED AS A BASIS FOR MANUFACTU RE
OR SALE OF EQUIPMENT OR DEVICES WITH OUT WRITTEN PERMISSION.

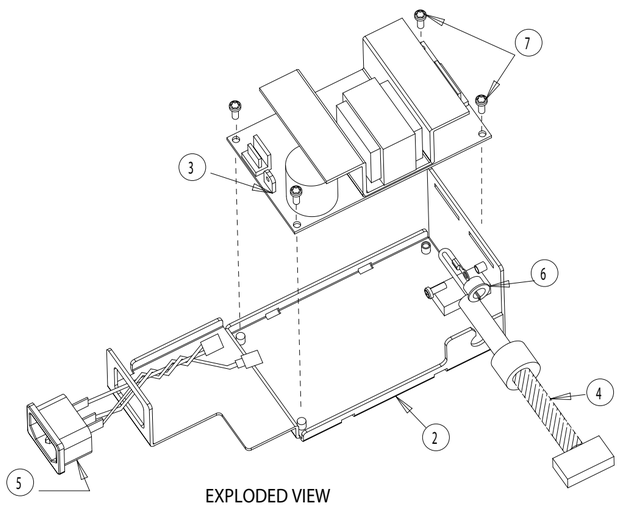
DRAWN: JB ENGEL	DATE: 09-Apr-99	Welch Allyn®
APPROVED: ZIP	DATE: 4/16/99	MATERIAL: -
REL TO PROD: J. BELLO	DATE: 4/16/99	FINISH: -
-	-	TITLE: ECG PATIENT CABLE
CAD SOFTWARE:	PRO E	
TRANSLATED FROM:		

UNLESS OTHERWISE SPECIFIED
TOLERANCES: .XX = ±.02, .XXX = ±.005, ANGLES ±2 °
DIMENSIONS ARE IN INCHES

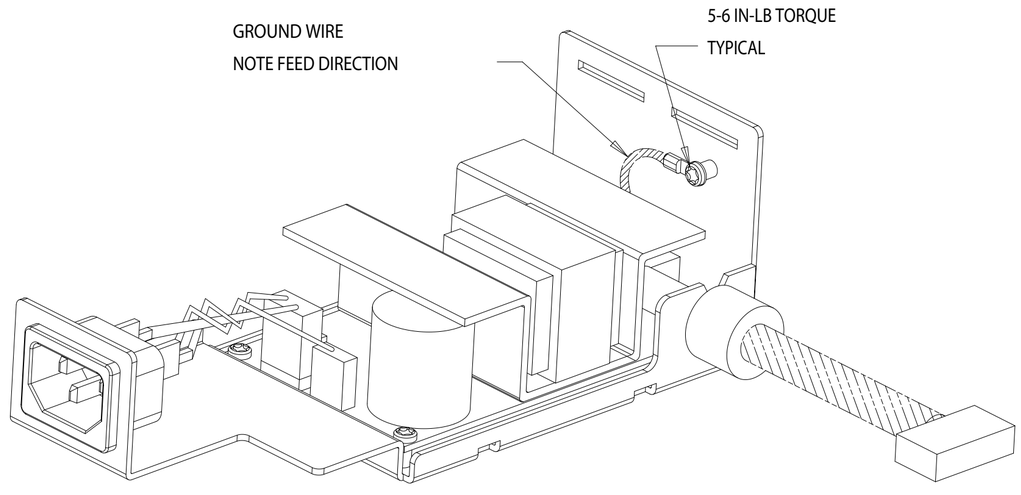
C	DRAWING NO. 620027	REV B
SCALE NONE	SHEET 1 of 1	

Figure D-29. 200/210/220 ECG patient cable.

REV	DESCRIPTION	ECN/ECO	INIT	DATE	CKD
A	RELEASE TO PROD. ENG.	5-39387	JRS	4/15/99	T.W.
B	REM'D FAN,TOP HSG & VIEWS W/FAN; DELETED WIRE TWIST NOTES	5-44568	CRW	5/8/02	JPK



EXPLODED VIEW



PARTIAL ASSEMBLY

620201-502	SUB-ASSEMBLY
620201-501	SUB-ASSEMBLY WITHOUT FAN
PART NO.	DESCRIPTION

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DRAWN: JB ENGEL	DATE: 13-Apr-99	Welch Allyn®
APPROVED: ZIP	DATE: 4/15/99	MATERIAL: -
REL TO PROD: J. BELLO	DATE: 4/15/99	FINISH: -
-	-	TITLE: POWER SUPPLY\ SUB-ASSEMBLY
CAD SOFTWARE:	PRO E	
TRANSLATED FROM:	ME-10	

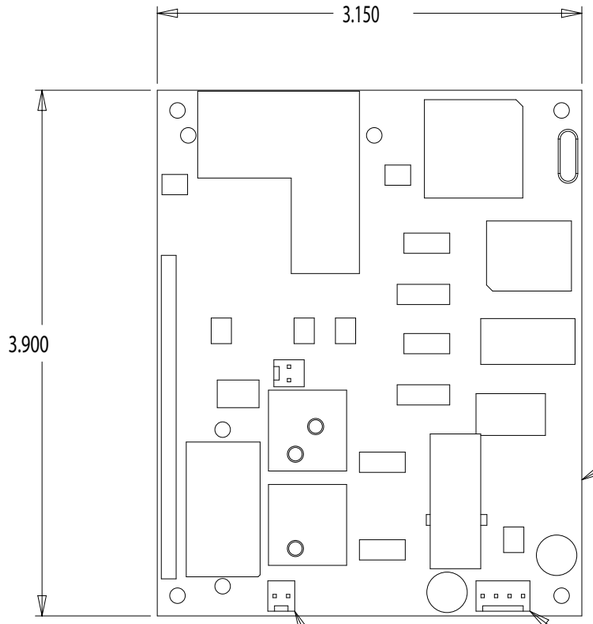
UNLESS OTHERWISE SPECIFIED
TOLERANCES: .XX = ±.02, .XXX = ±.005, ANGLES ±2° — DIMENSIONS ARE IN INCHES

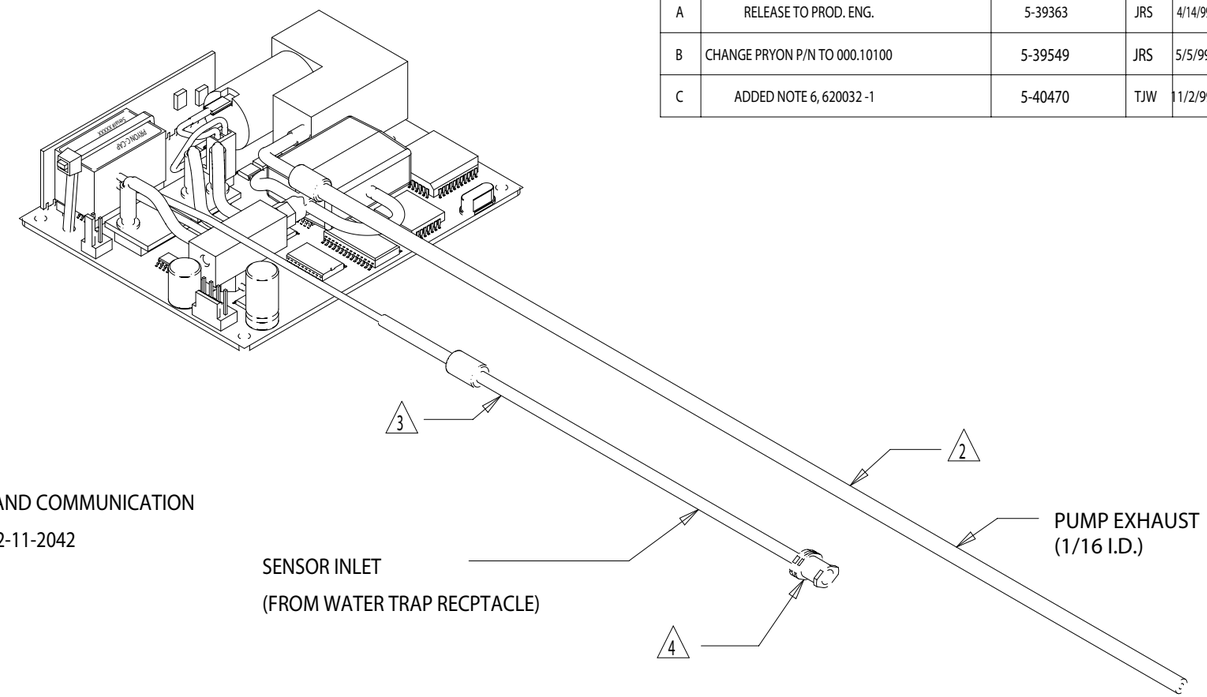
C	DRAWING NO. 620201	REV B
SCALE NONE	SHEET 1 of 1	

620201X1.MI

Figure D-30. 200/210/220 power supply sub assy.

REV	DESCRIPTION	ECN/ECO	INIT	DATE	CKD
A	RELEASE TO PROD. ENG.	5-39363	JRS	4/14/99	T.W.
B	CHANGE PRYON P/N TO 000.10100	5-39549	JRS	5/5/99	T.W.
C	ADDED NOTE 6, 620032 -1	5-40470	TJW	11/2/99	ASK





NOTES:

1. PRYON LC-101 GENERIC SUBASSEMBLY P/N 000.10100

2. NOMINAL LENGTH (FROM PUMP BODY T} O TUBING EXHAUST)
   13.4 INCHES.

3. NOMINAL LENGTH (FROM SENSOR BODY TO FEMALE LUER INLET)
   9.8 INCHES.

4. WATERTRAP AND WATERTRAP RECEPTAC} LE REQUIRED FOR OPERATION.

5. PACKAGING TO BE APPROVED BY WELC H ALLYN. HANDLING AND PACKAGING TO
   PREVENT DAMAGE DUE TO ESD, BENDI}} NG AND OTHER DAMAGE.

6. ASSY TO BE MARKED WITH MANUFACTURER'S SERIAL NUMBER.

B

THIS DWG -1	PRYON SERIAL #400 AND HIGHER
PART NO.	DESCRIPTION

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AND SHALL NOT BE REPRODUCED, OR COPI ED, OR USED AS A BASIS FOR MANUFACTU RE
OR SALE OF EQUIPMENT OR DEVICES WITH OUT WRITTEN PERMISSION.

DRAWN: WJM	DATE: 01-Apr-99	Welch Allyn®
APPROVED: ZIP	DATE: 4/14/99	MATERIAL: -
REL TO PROD: J. BELLO	DATE: 4/14/99	FINISH: -
-	-	TITLE: ETCO2 PCB ASSEMBLY
CAD SOFTWARE:	PROE	
TRANSLATED FROM:	ME10	

UNLESS OTHERWISE SPECIFIED
TOLERANCES: .XX = ±.02, .XXX = ±.005, ANGLES ±2 °
DIMENSIONS ARE IN INCHES

B	DRAWING NO. 620032	REV C
SCALE NONE	SHEET 1 of 1	

Figure D-31. 220 $ETCO_2$ PCB assembly.

REV	DESCRIPTION	ECN/ECO	INIT	DATE	CKD
B	SEE ECN (REV A REL. AS EXT ITM MSTR)	5-39954	ASK	7-12-99	T.W.
C	REVISED SUPPLIER P.N.	5-41401	JRS	5/18/00	T.W.

PERFORMANCE SPECIFICATIONS	
INPUT VOLTAGE	90 - 264 Vac
INPUT FREQUENCY	47 - 63 Hz
INPUT CURRENT (FULL LOAD)	1.6 A
OVERVOLTAGE PROTECTION	14 ±1.1 V
OUTPUT VOLTAGE	12 VDC @4.2 A
OUTPUT POWER-CONTINUOUS	50 W
OUTPUT POWER - PEAK	55 W
OPERATING TEMPERATURE	0°-50° C
EMI COMPLIANCE	CISPRII CLASS B (EN55011)
OUTPUT NOISE P-P	1%

J2 OUTPUT
1) OUTPUT 1 (+)
2) OUTPUT 1 (+)
3) OUTPUT 1 (+)
4) RETURN
5) RETURN
6) RETURN

J1 AC INPUT
1) LINE
2)
3) NEUTRAL

NOTES:

1. SUPPLIER: CONDOR POWER SUPPLIES INC.
   2311 STATHAM PKWY.
   OXNARD, CA. 93033
   PART NO: GLM50-12

2. SUPPLY MUST BE APPROVED TO
   UL 2601 AND IEC 601-1

3. SUPPLIER REV. C OR HIGHER

620150-1	REV B OR HIGHER
PART NO.	DESCRIPTION

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AND SHALL NOT BE REPRODUCED, OR COPI ED, OR USED AS A BASIS FOR MANUFACTU RE
OR SALE OF EQUIPMENT OR DEVICES WITH OUT WRITTEN PERMISSION.

DRAWN: ASK	DATE: 12-Jul-99	Welch Allyn®
APPROVED: ZIP	DATE: 7-12-99	MATERIAL: -
REL TO PROD: J. BELLO	DATE: 7-12-99	FINISH: -
-	-	TITLE: POWER SUPPLY, 50W
CAD SOFTWARE:	PRO/E	
TRANSLATED FROM:		

UNLESS OTHERWISE SPECIFIED
TOLERANCES: .XX = ±.02, .XXX = ±.005, ANGLES ±2°
DIMENSIONS ARE IN INCHES

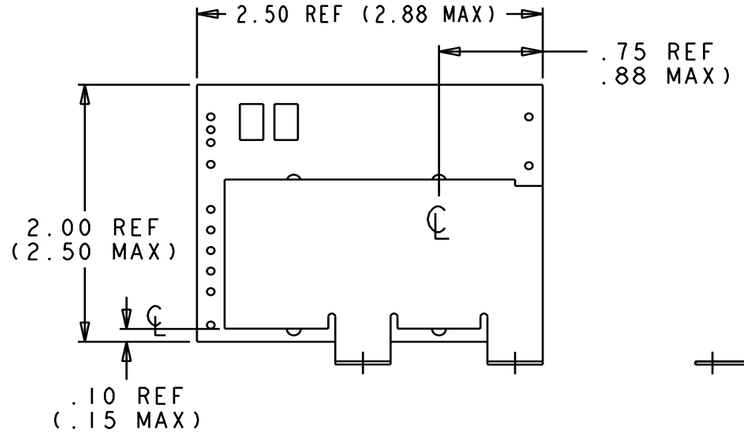
B	DRAWING NO. 620150	REV C
SCALE	SHEET 1 of 1	

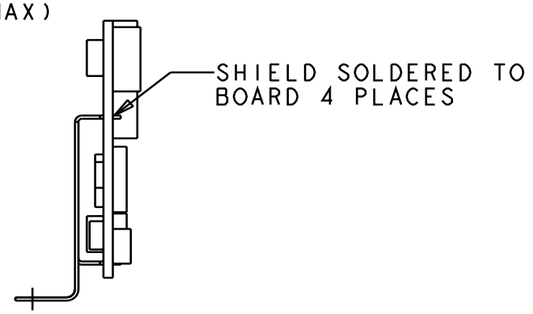
Figure D-32. 200/210/220 Power supply.

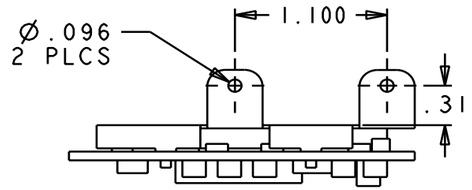
REV	DESCRIPTION	ECN/ECO	INIT	DATE	CKD
A	CHANGE	MT41168	DMC	5/8/97	TE
B	INTRODUCE 620154	MT41401	DMC	4/16/99	TE

125S210, 620154

SCALE 1.000







MANUFACTURER BOARD IDENTIFICATION:

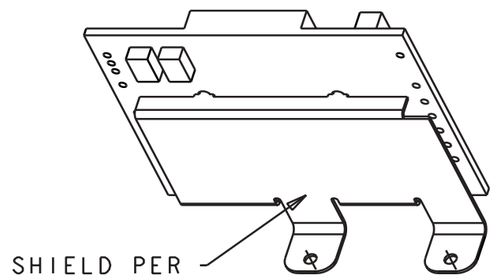
1754 - XXX B

FIRMWARE PART NO.

REVISION

P/N: 620154 IS FOR USE BY SKANEATELES - THE PART IS THE SAME AS 125S210

620154	ASSY, NONIN SPO2 BOARD	B
125S210	ASSY, NONIN SPO2 BOARD	A
PART NO.	DESCRIPTION	REV



SCALE 1.000

NOTES:

1. MANUFACTURER: NONIN MEDICAL, INC
   MINNEAPOLIS, MN
   P/N: 1771-003
2. BOARD TO MEET WELCH ALLYN SPECIFICATION 126P163.
3. PACKAGE INDIVIDUALLY WITH ESD PROTECTION.
4. MARK ASSEMBLY SERIAL NUMBER AND WELCH ALLYN P/N 125S210 IN ANY FREE AREA (LABEL PERMITTED).
5. WELCH ALLYN MUST BE NOTIFIED PRIOR TO ANY HARDWARE OR SOFTWARE CHANGE.

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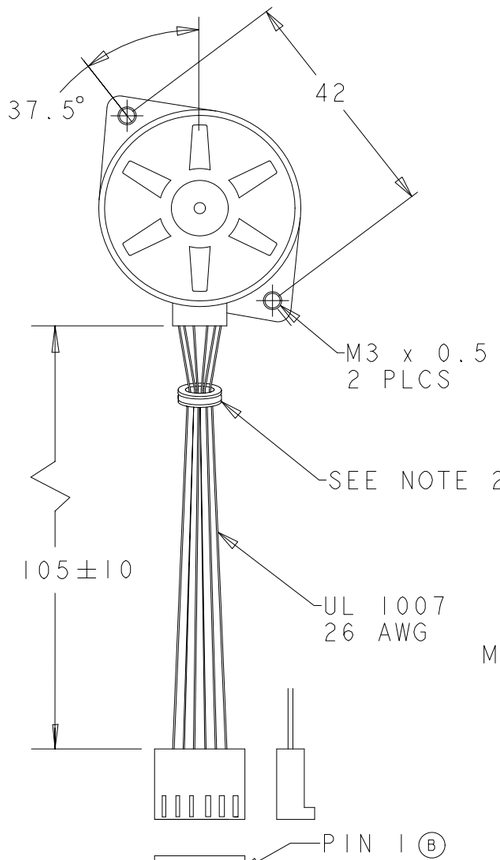
DRAWN D MCGLONE	DATE 3/8/95	Welch Allyn®
APPROVED B PIERCE	DATE 4/15/99	MATERIAL: -
REL TO PROD J HOWARD	DATE 4/15/99	FINISH: -
T EDMONDSON	4/15/99	TITLE: ASSY, NONIN SPO2 BOARD WITH SHIELD
CAD SOFTWARE:	PRO-E	
TRANSLATED FROM:		

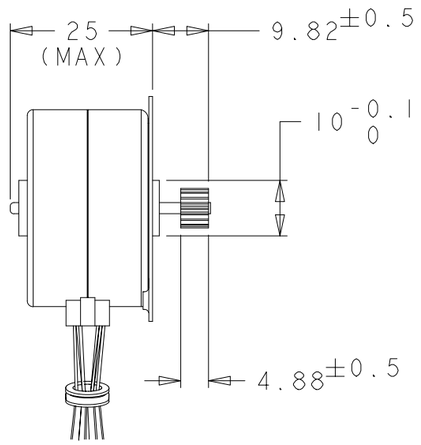
UNLESS OTHERWISE SPECIFIED
TOLERANCES .XX = ±.02 .XXX = ±.005 ANGLES ±2°
DIMENSIONS ARE IN INCHES

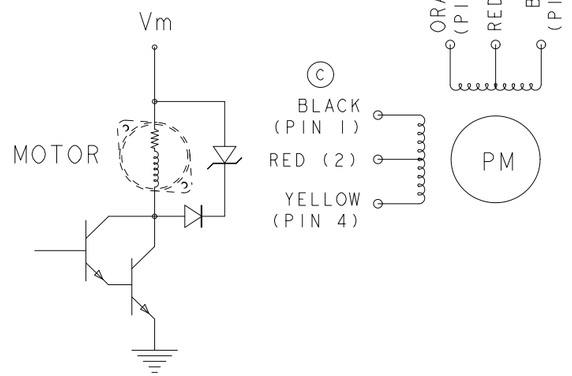
B	DRAWING NO. 125S210, 620154	REV B
SCALE 1.000	SHEET 1 of 1	

Figure D-33. Nonin SpO2 Board with Shield.

REV	DESCRIPTION	ECN/ECO	INIT	DATE	CKD
A	RELEASE TO PRODUCTION (X16)	5-39056	JRS	2/25/99	T.W.
B	REVISED WIRING AND PIN LOCATIONS	5-39993	JRS	7/20/99	T.W.
C	PART NO. ON NOTE 1 WAS ""-T4P REVISED WIRE COLORS	5-40409	JRS	10/20/99	T.W.







MOLEX 22-01-3067 HOUSING
08-50-0144 CONTACT

GEAR DATA

NUMBER OF TEETH: 15
DIAMETRAL PITCH: 64
PRESSURE ANGLE: 20°
AGMA CLASS 6 OR BETTER
MATERIAL: BRASS CDA 360

STEP	PIN 1	PIN 2	PIN 3	PIN 4	PIN 5	PIN 6
	BLACK	RED	BROWN	YELLOW	RED	ORANGE
1	-	+	-		+	
2		+	-	-	+	
3		+		-	+	-
4	-	+			+	-

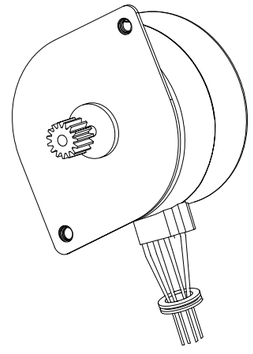
CW

CCW

(B) VIEWED FROM GEAR END

DIM'S ARE IN mm

NOTES:
(C) 1. NMB PART NO. 15BA-H056-02P
SPECIFICATIONS:
12V UNIPOLAR WINDING
DC RESISTANCE 30Ω
STEP ANGLE 15°
MAX HOLDING TORQUE 500 g-cm @ .4A/PHASE
PULL OUT TORQUE 230 g-cm @ 330 pps
PULL IN TORQUE 170 g-cm @ 330 pps
NO LOAD SPEED 1000 pps MIN.
2. GROMMET SPECIFICATIONS:
3/16 I.D. x 13/32 O.D. x 5/16 THK
GROOVE Ø9/32 x 3/32
MAY BE PURCHASED FROM AME, P/N 65GS-10
3. DIMENSIONS ARE FOR REFERENCE ONLY.



-	-
PART NO.	DESCRIPTION

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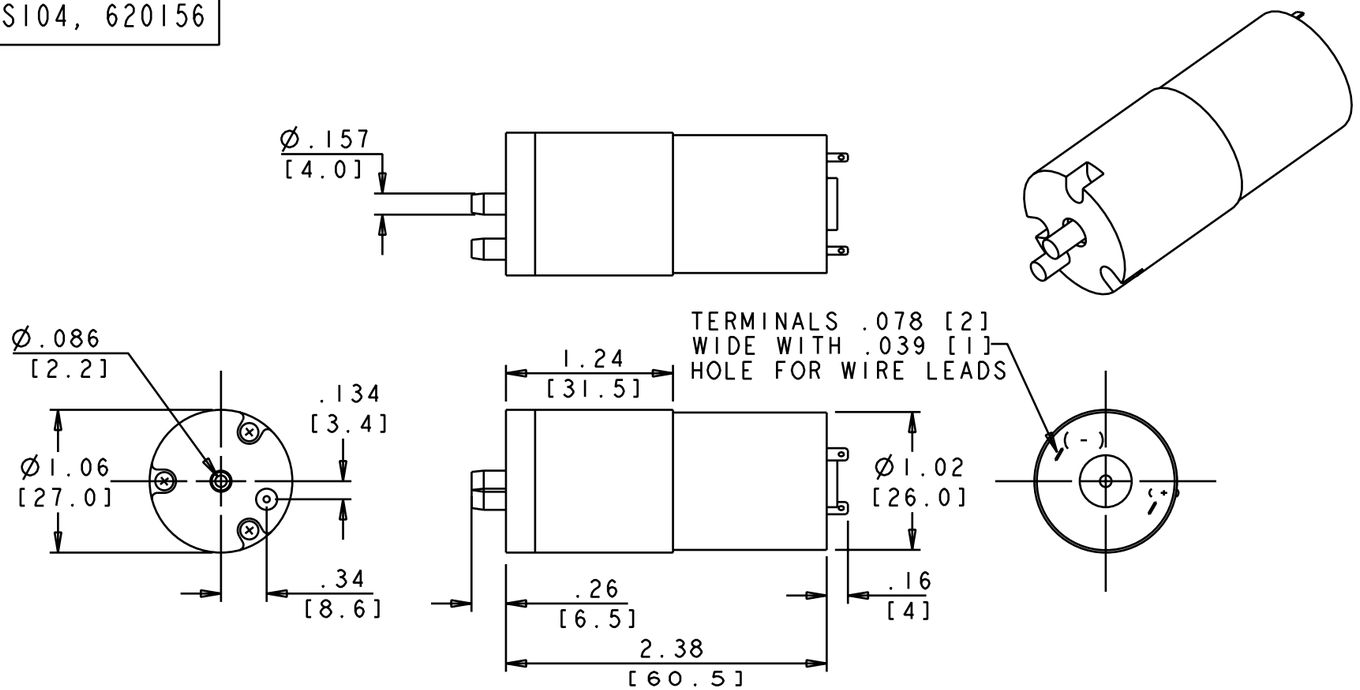
DRAWN: MAHONEY	DATE: 19-Feb-99	Welch Allyn®
APPROVED: ZIP	DATE: 03/01/99	MATERIAL: -
REL TO PROD: J. BELLO	DATE: 02/26/99	FINISH: -
-	-	TITLE: MOTOR, STEPPER
CAD SOFTWARE:	ProE	
TRANSLATED FROM:	dxf	

UNLESS OTHERWISE SPECIFIED
TOLERANCES DIMENSIONS
.XX = ±.02 ARE IN
.XXX = ±.005 INCHES
ANGLES ±2°

B	DRAWING NO. 620152	REV C
SCALE NONE	SHEET 1 of 1	

REV	DESCRIPTION	ECN/ECO	INIT	DATE	CKD
A	CHANGE	AMT40863-72	DMC	10/25/96	TE
B	INTRODUCE 620156	MT41401	DMC	4/16/99	TE

168S104, 620156



P/N: 620156 IS FOR USE BY SKANEATELES - THE PART IS THE SAME AS 168S104

NOTES:

1. PURCHASE FROM OKEN SEIKO CO., LTD, INAGI TOKYO, JAPAN
   PART NUMBER: P05C09.
2. DC MOTOR POWER REQUIREMENTS: RATED VOLTAGE: 6 VDC
   CURRENT: <500 mA MAX DURING PRESSURIZATION FROM 0-300 mmHg
   (STANDARD VOLUME OF 500 cc).
3. REFERENCE LEAK RATE: THE PUMP LEAK RATE WILL BE LESS THAN 15 mmHg IN 15 SECONDS WITH A 100±10 cc VOLUME PRESSURIZED TO 50 ±5 mmHg ATTACHED.
   THE PRESSURE IN THE VOLUME MUST BE STABILIZED FOR A MINIMUM OF 20 SECONDS BEFORE BEING ATTACHED TO THE PUMP. THE PUMP MUST BE RUN FOR A MINIMUM OF .75 SECONDS BEFORE BEING ATTACHED TO THE PRESSURIZED VOLUME.
4. PUMP UP SPEED: MUST PRESSURIZE STANDARD VOLUME OF 500 cc TO 5.8 PSI (300 mmHg) IN LESS THAN 10 SECONDS AT RATED POWER.

   FOR REF ONLY
   - MAXIMUM PRESSURE: 7.7 PSI (400 mmHg).
   - FLOW RATE: 2.0 LITERS / MINUTE AT NO LOAD
     1.0 LITERS/MIN AT 3.9 PSI (200 mmHg)
5. TEMPERATURE: AT 15% TO 90% RELATIVE HUMIDITY (NONCONDENSING)
   OPERATING: 0°C - +40°C, STORAGE: -20°C - +50°C

620156	PUMP, 6 VDC, 10 PSI	B
168S104	PUMP, 6 VDC, 10 PSI	A
PART NO.	DESCRIPTION	REV

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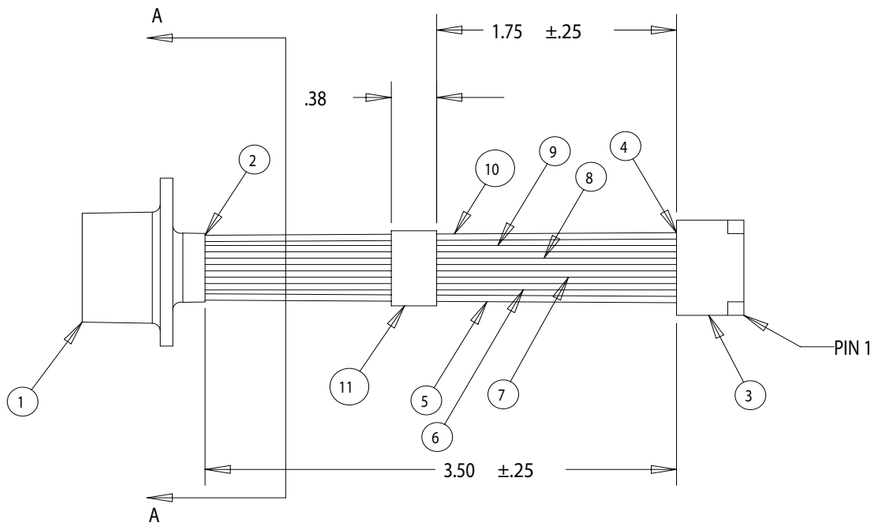
DRAWN D MCGLONE	DATE 4/3/95	Welch Allyn®
APPROVED B PIERCE	DATE 4/15/99	MATERIAL: -
REL TO PROD J HOWARD	DATE 4/15/99	FINISH: -
T EDMONDSON	4/15/99	TITLE: PUMP, PNEUMATIC, 6 VDC, 10 PSI
CAD SOFTWARE:	PRO-E	
TRANSLATED FROM:		

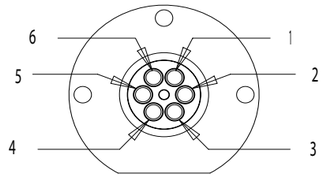
UNLESS OTHERWISE SPECIFIED
TOLERANCES .XX = ±.02 .XXX = ±.005 ANGLES ±2°
DIMENSIONS ARE IN INCHES

B	DRAWING NO. 168S104, 620156	REV B
	SCALE 1.000	SHEET 1 of 1

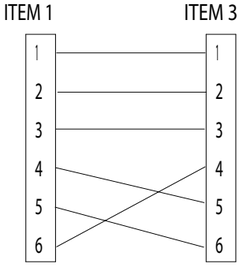
Figure D-35. Pump Pneumatic.

REV	DESCRIPTION	ECN/ECO	INIT	DATE	CKD
A	RELEASE TO PRODUCTION (X2)	5-39025	JRS	2/18/99	T.W.





SECTION A-A



NOTES:

1. ALL CONNECTORS ARE TO BE UL RECOG NIZED COMPONENTS AND CSA CERTIFIED.
   CONNECTOR MATERIAL SHALL HAVE FLA MMABILITY RATINGS OF 94V-2 OR BETTER .

2. WIRE SPECIFIATIONS

   -TYPE U.L. 1061, CSA AWM I A/B FT1

   -COLOR CODED .009 THK. (NOM) PVC INS ULATION

   -TEMP RANGE: -10 ° C TO +80 ° C

   -VOLTAGE RATING: 300V

   -STRANDED TINNED COPPER CONDUCTOR

   -RECOGNIZED COMPONENT MARK RU AND CS A MUST
   APPEAR ON SPOOL OR BE STAMPED ON WI RE

QTY	ITEM	DESCRIPTION	PART NO.
1	11	SHRINK TUBE	
1	10	WIRE, 22GA, GREEN	
1	9	WIRE, 22GA, BROWN	
1	8	WIRE, 22GA, BLUE	
1	7	WIRE, 22GA, RED	
1	6	WIRE, 22GA, BLACK	
1	5	WIRE, 22GA, WHITE	
6	4	CONTACTS, MOLEX 08-5	0-0113
1	3	6 PIN CONNECTOR, MOL	EX 22-01-3067
6	2	ECG PINS (FEMALE), A	MP-66105-3
1	1	ECG CONNECTOR WA PAR	T # 620102

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AND SHALL NOT BE REPRODUCED, OR COPI ED, OR USED AS A BASIS FOR MANUFACTU RE
OR SALE OF EQUIPMENT OR DEVICES WITH OUT WRITTEN PERMISSION.

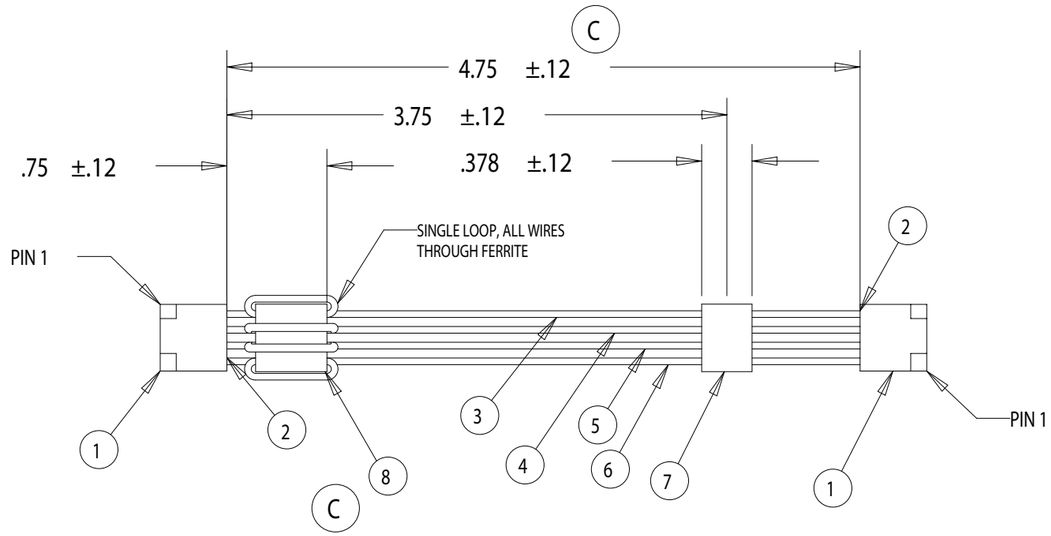
DRAWN: JB ENGEL	DATE: 13-Jan-99	Welch Allyn®
APPROVED: ZIP	DATE: 2/19/99	MATERIAL: -
REL TO PROD: J. BELLO	DATE: 2/19/99	FINISH: -
-	-	TITLE: CABLE ASSY ECG
CAD SOFTWARE:	PE	
TRANSLATED FROM:	ME10	

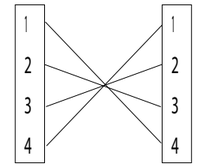
UNLESS OTHERWISE SPECIFIED
TOLERANCES: .XX = ±.02, .XXX = ±.005, ANGLES ±2 °
DIMENSIONS ARE IN INCHES

SIZE	DRAWING NO.	REV
B	620165	A
SCALE NONE	SHEET 1 of 1	

Figure D-36. 200/210/220 ECG cable assembly.

REV	DESCRIPTION	ECN/ECO	INIT	DATE	CKD
A	RELEASE TO PRODUCTION (X2)	5-39025	JRS	2/18/99	T.W.
B	CHANGE WIRE SPEC IN NOTE 2	5-39543	JRS	5/5/99	T.W.
C	ADD .75" IN LENGTH ADD FERRITE CHANGED PART # 620166-1	5-39879	JRS	6/24/99	T.W.





NOTES:

1. ALL CONNECTORS ARE TO BE UL RECOG NIZED COMPONENTS AND CSA CERTIFIED.
CONNECTOR MATERIAL SHALL HAVE FLA MMABILITY RATINGS OF 94V-2 OR BETTER .

2. WIRE SPECIFICATIONS

(B) -TYPE U.L. 1061, CSA AWM I A/B FT1
-COLOR CODED .009 THK. (NOM) PVC INS ULATION
-TEMP RANGE: -10 ° C TO +80 ° C
-VOLTAGE RATING: 300V
-STRANDED TINNED COPPER CONDUCTOR
-RECOGNIZED COMPONENT MARK RU AND CS A MUST
APPEAR ON SPOOL OR BE STAMPED ON WI RE

C

QTY	ITEM	DESCRIPTION	
1	8	FAIR RITE P/N 26443801902	
1	7	SHRINK TUBE	
1	6	WIRE, 22GA, YELLOW	
1	5	WIRE, 22GA, ORANGE	
1	4	WIRE, 22GA, RED	
1	3	WIRE, 22GA, BROWN	
8	2	CONTACTS, MOLEX 08-5	0-0113
2	1	4 PIN CONNECTOR, MOL	EX 22-01-3047

PART NO.	DESCRIPTION
620166-1	THIS DRAWING REV C AND ABOVE
620166	

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AND SHALL NOT BE REPRODUCED, OR COPI ED, OR USED AS A BASIS FOR MANUFACTU RE
OR SALE OF EQUIPMENT OR DEVICES WITH OUT WRITTEN PERMISSION.

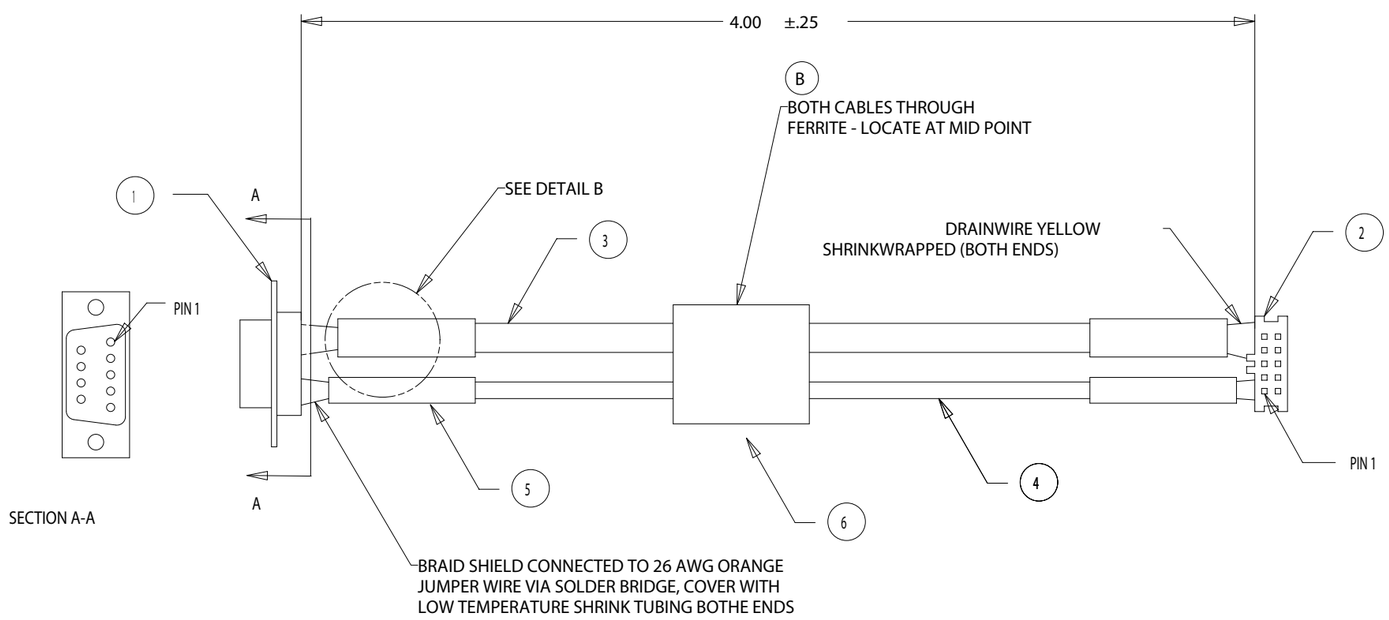
DRAWN: JB ENGEL	DATE: 13-Jan-99	Welch Allyn®
APPROVED: ZIP	DATE: 2/19/99	MATERIAL: -
REL TO PROD: J. BELLO	DATE: 2/19/99	FINISH: -
-	-	TITLE: CABLE ASSY CO2
CAD SOFTWARE:	PE	
TRANSLATED FROM:	ME10	

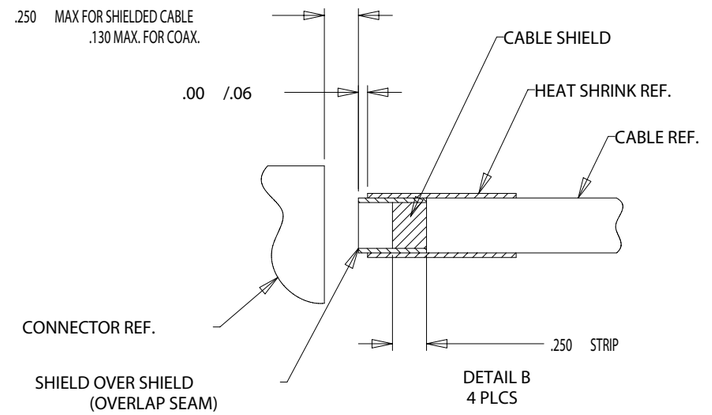
UNLESS OTHERWISE SPECIFIED
TOLERANCES .XX = ±.02 .XXX = ±.005 ANGLES ±2 °
DIMENSIONS ARE IN INCHES

	DRAWING NO.	REV
B	620166	C
SCALE NONE	SHEET 1 of 1	

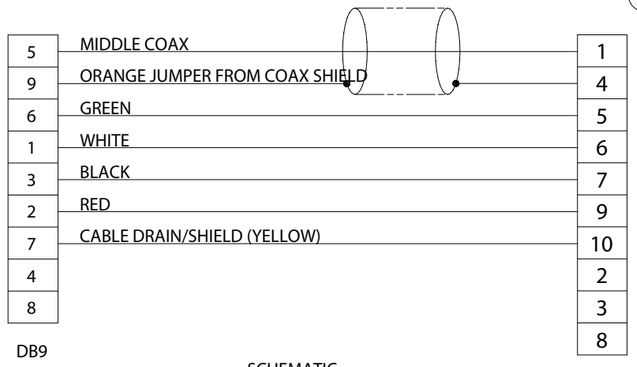
Figure D.37. CO_2 cable assembly.

REV	DESCRIPTION	ECN/ECO	INIT	DATE	CKD
A	RELEASE TO PRODUCTION (X2)	5-39025	JRS	2/18/99	T.W.
B	ADD FERRITE, ITEM 6 CHANGED PART NO. TO 620169-1	5-39627	JRS	5/14/99	T.W.
C	CHANGE CONN. TO METAL SHELL CHANGED PART NO. TO 620169-2	5-39885	JRS	6/29/99	T.W.





	QTY	ITEM	DESCRIPTION	
B	1	6	FAIR-RITE 2643625102	
	4	5	HEAT SHRINK	
	1	4	COAX CABLE, BELDON#821	6
	1	3	SHIELDED CABLE, CAROL#	CO742 W/ DRAIN
	1	2	3M CONNECTOR, 89110-0101	
C	1	1	SPO2 CONNECTOR, AMP #7	45491-2



NOTES:

1. ALL CONNECTORS ARE TO BE UL RECOG NIZED COMPONENTS AND CSA CERTIFIED.
   CONNECTOR MATERIAL SHALL HAVE FLA MMABILITY RATINGS OF 94V-2 OR BETTER .
2. CABLE ASSEMBLY TO BE 100% TESTED FOR POINT TO POINT AND SHIELD OVER SHIELD CONTINUITY.

C	620169-2 THIS PART REV C AND ABOVE
B	620169-1 THIS PART REV B AND ABOVE
	620169 THIS PART
	PART NO. DESCRIPTION

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OR SALE OF EQUIPMENT OR DEVICES WITH OUT WRITTEN PERMISSION.

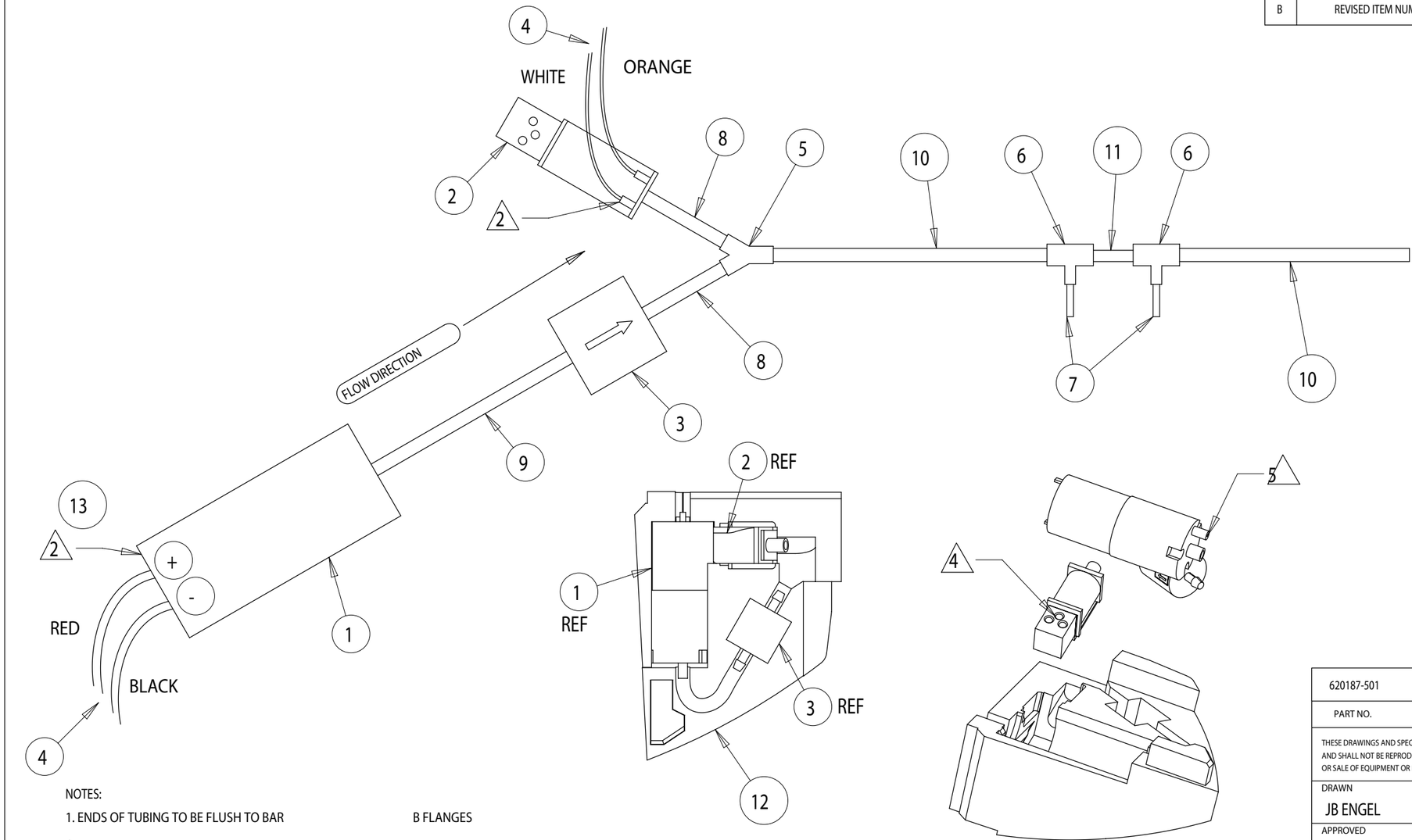
DRAWN JB ENGEL	DATE 14-May-99	Welch Allyn®
APPROVED ZIP	DATE 2/18/99	MATERIAL: -
REL TO PROD J. BELLO	DATE 2/18/99	FINISH: -
-	-	TITLE: CABLE ASSY NELLCOR SENSOR
CAD SOFTWARE:	PE	
TRANSLATED FROM:	ME10	

UNLESS OTHERWISE SPECIFIED
TOLERANCES .XX = ±.02 .XXX = ±.005 ANGLES ±2 °
DIMENSIONS ARE IN INCHES

B	DRAWING NO. 620169	REV C
SCALE NONE	SHEET 1 of 1	

Figure D-38. Nellcor sensor cable assy.

REV	DESCRIPTION	ECN/ECO	INIT	DATE	CKD
A	RELEASE TO PROD. ENG.	5-39387	JRS	4/15/99	T.W.
B	REVISED ITEM NUMBERS	5-39513	TJW	5/3/99	T.W.



NOTES:

1. ENDS OF TUBING TO BE FLUSH TO BAR B FLANGES

2 SOLDER WIRE FROM ITEM 4 TO PUMP TERMINALS USING SOLDER ITEM 13.

3 ATTACH FAST-ONS FROM ITEM 4.

4 MANIFOLD ORIENTATION - HOLES FACI NG UP AS NOTED

5 PUMP INTAKE ORIENTATION - TUBE ON TOP SIDE AS NOTED.

620187-501	PNEUMATIC SUB-ASSEMBLY
PART NO.	DESCRIPTION

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DRAWN: JB ENGEL	DATE: 13-Apr-99	Welch Allyn®
APPROVED: ZIP	DATE: 4/15/99	MATERIAL: -
REL TO PROD: J. BELLO	DATE: 4/15/99	FINISH: -
-	-	TITLE: PNEUMATIC SUB-ASSY
CAD SOFTWARE:	PRO E	
TRANSLATED FROM:	ME-10	

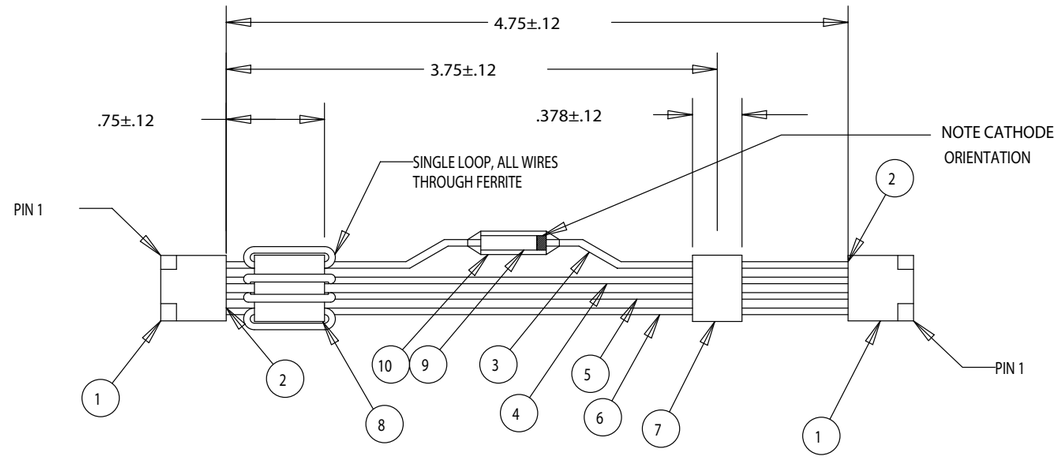
UNLESS OTHERWISE SPECIFIED

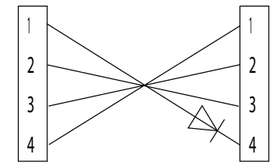
TOLERANCES: .XX = ±.02, .XXX = ±.005, ANGLES ±2 ° — DIMENSIONS ARE IN INCHES

B	DRAWING NO. 620187	REV B
SCALE NONE	SHEET 1 of 1	

Figure D-39. 200/210/220 Pneumatic sub assy.

REV	DESCRIPTION	ECN/ECO	INIT	DATE	CKD
A	RELEASE TO PRODUCTION	5-39928	JRS	7/2/99	T.W.
B	CHANGE DIODE VENDOR	5-44091	RLB	1/22/02	





QTY	ITEM	DESCRIPTION	
1	10	CLEAR HEAT SHRINK	
1	9	DIODE,VISHAY TELEFUNKEN P/N IN4148	
1	8	FAIR RITE P/N 2643801902	
1	7	SHRINK TUBE	
1	6	WIRE, 22GA, YELLOW	
1	5	WIRE, 22GA, ORANGE	
1	4	WIRE, 22GA, RED	
1	3	WIRE, 22GA, BROWN	
8	2	CONTACTS, MOLEX 08-5	0-0113
2	1	4 PIN CONNECTOR, MOL	EX 22-01-3047

NOTES:

1. ALL CONNECTORS ARE TO BE UL RECOG NIZED COMPONENTS AND CSA CERTIFIED.
   CONNECTOR MATERIAL SHALL HAVE FLA MMABILITY RATINGS OF 94V-2 OR BETTER .

2. WIRE SPECIFICATIONS

   -TYPE U.L. 1061, CSA AWM I A/B FT1

   -COLOR CODED .009 THK. (NOM) PVC INSULATION

   -TEMP RANGE: -10 C TO +80 ° ° C

   -VOLTAGE RATING: 300V

   -STRANDED TINNED COPPER CONDUCTOR

   -RECOGNIZED COMPONENT MARK RU AND CS A MUST
   APPEAR ON SPOOL OR BE STAMPED ON WI RE

PART NO.	DESCRIPTION

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OR SALE OF EQUIPMENT OR DEVICES WITH OUT WRITTEN PERMISSION.

DRAWN JB ENGEL	DATE 13-Jan-99	Welch Allyn®
APPROVED CDM	DATE 7/2/99	MATERIAL: -
REL TO PROD J. BELLO	DATE 7/2/99	FINISH: -
-	-	TITLE: CABLE ASSY CO2
CAD SOFTWARE:	PE	
TRANSLATED FROM:	ME10	

UNLESS OTHERWISE SPECIFIED
TOLERANCES .XX = ±.02 .XXX = ±.005 ANGLES ±2 °
DIMENSIONS ARE IN INCHES

B	DRAWING NO. 620524	REV B
SCALE NONE	SHEET 1 of 1	

Figure D-40. 220 CO_2 cable assy.

Table E-1. Calibration Date Table.

Calibration Date	Number of Days
1/1/2003	1826
1/2/2003	1827
1/3/2003	1828
1/4/2003	1829
1/5/2003	1830
1/6/2003	1831
1/7/2003	1832
1/8/2003	1833
1/9/2003	1834
1/10/2003	1835
1/11/2003	1836
1/12/2003	1837
1/13/2003	1838
1/14/2003	1839
1/15/2003	1840
1/16/2003	1841
1/17/2003	1842
1/18/2003	1843
1/19/2003	1844
1/20/2003	1845
1/21/2003	1846
1/22/2003	1847
1/23/2003	1848
1/24/2003	1849
1/25/2003	1850
1/26/2003	1851
1/27/2003	1852
1/28/2003	1853
1/29/2003	1854
1/30/2003	1855
1/31/2003	1856
2/1/2003	1857
2/2/2003	1858
2/3/2003	1859
2/4/2003	1860
2/5/2003	1861
2/6/2003	1862
2/7/2003	1863
2/8/2003	1864
2/9/2003	1865
2/10/2003	1866
2/11/2003	1867
2/12/2003	1868
2/13/2003	1869
2/14/2003	1870
2/15/2003	1871
2/16/2003	1872
2/17/2003	1873
2/18/2003	1874
2/19/2003	1875
2/20/2003	1876
2/21/2003	1877
2/22/2003	1878
2/23/2003	1879
2/24/2003	1880
2/25/2003	1881
2/26/2003	1882
2/27/2003	1883
2/28/2003	1884
3/1/2003	1885
3/2/2003	1886
3/3/2003	1887
3/4/2003	1888
3/5/2003	1889
3/6/2003	1890
3/7/2003	1891
3/8/2003	1892
3/9/2003	1893
3/10/2003	1894
3/11/2003	1895
3/12/2003	1896
3/13/2003	1897
3/14/2003	1898
3/15/2003	1899
3/16/2003	1900
3/17/2003	1901
3/18/2003	1902
3/19/2003	1903
3/20/2003	1904
3/21/2003	1905
3/22/2003	1906

Calibration Date	Number of Days	Calibration Date	Number of Days
3/23/2003	1907	5/3/2003	1948
3/24/2003	1908	5/4/2003	1949
3/25/2003	1909	5/5/2003	1950
3/26/2003	1910	5/6/2003	1951
3/27/2003	1911	5/7/2003	1952
3/28/2003	1912	5/8/2003	1953
3/29/2003	1913	5/9/2003	1954
3/30/2003	1914	5/10/2003	1955
3/31/2003	1915	5/11/2003	1956
4/1/2003	1916	5/12/2003	1957
4/2/2003	1917	5/13/2003	1958
4/3/2003	1918	5/14/2003	1959
4/4/2003	1919	5/15/2003	1960
4/5/2003	1920	5/16/2003	1961
4/6/2003	1921	5/17/2003	1962
4/7/2003	1922	5/18/2003	1963
4/8/2003	1923	5/19/2003	1964
4/9/2003	1924	5/20/2003	1965
4/10/2003	1925	5/21/2003	1966
4/11/2003	1926	5/22/2003	1967
4/12/2003	1927	5/23/2003	1968
4/13/2003	1928	5/24/2003	1969
4/14/2003	1929	5/25/2003	1970
4/15/2003	1930	5/26/2003	1971
4/16/2003	1931	5/27/2003	1972
4/17/2003	1932	5/28/2003	1973
4/18/2003	1933	5/29/2003	1974
4/19/2003	1934	5/30/2003	1975
4/20/2003	1935	5/31/2003	1976
4/21/2003	1936	6/1/2003	1977
4/22/2003	1937	6/2/2003	1978
4/23/2003	1938	6/3/2003	1979
4/24/2003	1939	6/4/2003	1980
4/25/2003	1940	6/5/2003	1981
4/26/2003	1941	6/6/2003	1982
4/27/2003	1942	6/7/2003	1983
4/28/2003	1943	6/8/2003	1984
4/29/2003	1944	6/9/2003	1985
4/30/2003	1945	6/10/2003	1986
5/1/2003	1946	6/11/2003	1987
5/2/2003	1947	6/12/2003	1988

Calibration Date	Number of Days	Calibration Date	Number of Days
6/13/2003	1989	7/24/2003	2030
6/14/2003	1990	7/25/2003	2031
6/15/2003	1991	7/26/2003	2032
6/16/2003	1992	7/27/2003	2033
6/17/2003	1993	7/28/2003	2034
6/18/2003	1994	7/29/2003	2035
6/19/2003	1995	7/30/2003	2036
6/20/2003	1996	7/31/2003	2037
6/21/2003	1997	8/1/2003	2038
6/22/2003	1998	8/2/2003	2039
6/23/2003	1999	8/3/2003	2040
6/24/2003	2000	8/4/2003	2041
6/25/2003	2001	8/5/2003	2042
6/26/2003	2002	8/6/2003	2043
6/27/2003	2003	8/7/2003	2044
6/28/2003	2004	8/8/2003	2045
6/29/2003	2005	8/9/2003	2046
6/30/2003	2006	8/10/2003	2047
7/1/2003	2007	8/11/2003	2048
7/2/2003	2008	8/12/2003	2049
7/3/2003	2009	8/13/2003	2050
7/4/2003	2010	8/14/2003	2051
7/5/2003	2011	8/15/2003	2052
7/6/2003	2012	8/16/2003	2053
7/7/2003	2013	8/17/2003	2054
7/8/2003	2014	8/18/2003	2055
7/9/2003	2015	8/19/2003	2056
7/10/2003	2016	8/20/2003	2057
7/11/2003	2017	8/21/2003	2058
7/12/2003	2018	8/22/2003	2059
7/13/2003	2019	8/23/2003	2060
7/14/2003	2020	8/24/2003	2061
7/15/2003	2021	8/25/2003	2062
7/16/2003	2022	8/26/2003	2063
7/17/2003	2023	8/27/2003	2064
7/18/2003	2024	8/28/2003	2065
7/19/2003	2025	8/29/2003	2066
7/20/2003	2026	8/30/2003	2067
7/21/2003	2027	8/31/2003	2068
7/22/2003	2028	9/1/2003	2069
7/23/2003	2029	9/2/2003	2070

Calibration Date	Number of Days	Calibration Date	Number of Days
9/3/2003	2071	10/14/2003	2112
9/4/2003	2072	10/15/2003	2113
9/5/2003	2073	10/16/2003	2114
9/6/2003	2074	10/17/2003	2115
9/7/2003	2075	10/18/2003	2116
9/8/2003	2076	10/19/2003	2117
9/9/2003	2077	10/20/2003	2118
9/10/2003	2078	10/21/2003	2119
9/11/2003	2079	10/22/2003	2120
9/12/2003	2080	10/23/2003	2121
9/13/2003	2081	10/24/2003	2122
9/14/2003	2082	10/25/2003	2123
9/15/2003	2083	10/26/2003	2124
9/16/2003	2084	10/27/2003	2125
9/17/2003	2085	10/28/2003	2126
9/18/2003	2086	10/29/2003	2127
9/19/2003	2087	10/30/2003	2128
9/20/2003	2088	10/31/2003	2129
9/21/2003	2089	11/1/2003	2130
9/22/2003	2090	11/2/2003	2131
9/23/2003	2091	11/3/2003	2132
9/24/2003	2092	11/4/2003	2133
9/25/2003	2093	11/5/2003	2134
9/26/2003	2094	11/6/2003	2135
9/27/2003	2095	11/7/2003	2136
9/28/2003	2096	11/8/2003	2137
9/29/2003	2097	11/9/2003	2138
9/30/2003	2098	11/10/2003	2139
10/1/2003	2099	11/11/2003	2140
10/2/2003	2100	11/12/2003	2141
10/3/2003	2101	11/13/2003	2142
10/4/2003	2102	11/14/2003	2143
10/5/2003	2103	11/15/2003	2144
10/6/2003	2104	11/16/2003	2145
10/7/2003	2105	11/17/2003	2146
10/8/2003	2106	11/18/2003	2147
10/9/2003	2107	11/19/2003	2148
10/10/2003	2108	11/20/2003	2149
10/11/2003	2109	11/21/2003	2150
10/12/2003	2110	11/22/2003	2151
10/13/2003	2111	11/23/2003	2152

Calibration Date	Number of Days	Calibration Date	Number of Days
11/24/2003	2153	1/4/2004	2194
11/25/2003	2154	1/5/2004	2195
11/26/2003	2155	1/6/2004	2196
11/27/2003	2156	1/7/2004	2197
11/28/2003	2157	1/8/2004	2198
11/29/2003	2158	1/9/2004	2199
11/30/2003	2159	1/10/2004	2200
12/1/2003	2160	1/11/2004	2201
12/2/2003	2161	1/12/2004	2202
12/3/2003	2162	1/13/2004	2203
12/4/2003	2163	1/14/2004	2204
12/5/2003	2164	1/15/2004	2205
12/6/2003	2165	1/16/2004	2206
12/7/2003	2166	1/17/2004	2207
12/8/2003	2167	1/18/2004	2208
12/9/2003	2168	1/19/2004	2209
12/10/2003	2169	1/20/2004	2210
12/11/2003	2170	1/21/2004	2211
12/12/2003	2171	1/22/2004	2212
12/13/2003	2172	1/23/2004	2213
12/14/2003	2173	1/24/2004	2214
12/15/2003	2174	1/25/2004	2215
12/16/2003	2175	1/26/2004	2216
12/17/2003	2176	1/27/2004	2217
12/18/2003	2177	1/28/2004	2218
12/19/2003	2178	1/29/2004	2219
12/20/2003	2179	1/30/2004	2220
12/21/2003	2180	1/31/2004	2221
12/22/2003	2181	2/1/2004	2222
12/23/2003	2182	2/2/2004	2223
12/24/2003	2183	2/3/2004	2224
12/25/2003	2184	2/4/2004	2225
12/26/2003	2185	2/5/2004	2226
12/27/2003	2186	2/6/2004	2227
12/28/2003	2187	2/7/2004	2228
12/29/2003	2188	2/8/2004	2229
12/30/2003	2189	2/9/2004	2230
12/31/2003	2190	2/10/2004	2231
1/1/2004	2191	2/11/2004	2232
1/2/2004	2192	2/12/2004	2233
1/3/2004	2193	2/13/2004	2234

Calibration Date	Number of Days	Calibration Date	Number of Days
2/14/2004	2235	3/26/2004	2276
2/15/2004	2236	3/27/2004	2277
2/16/2004	2237	3/28/2004	2278
2/17/2004	2238	3/29/2004	2279
2/18/2004	2239	3/30/2004	2280
2/19/2004	2240	3/31/2004	2281
2/20/2004	2241	4/1/2004	2282
2/21/2004	2242	4/2/2004	2283
2/22/2004	2243	4/3/2004	2284
2/23/2004	2244	4/4/2004	2285
2/24/2004	2245	4/5/2004	2286
2/25/2004	2246	4/6/2004	2287
2/26/2004	2247	4/7/2004	2288
2/27/2004	2248	4/8/2004	2289
2/28/2004	2249	4/9/2004	2290
2/29/2004	2250	4/10/2004	2291
3/1/2004	2251	4/11/2004	2292
3/2/2004	2252	4/12/2004	2293
3/3/2004	2253	4/13/2004	2294
3/4/2004	2254	4/14/2004	2295
3/5/2004	2255	4/15/2004	2296
3/6/2004	2256	4/16/2004	2297
3/7/2004	2257	4/17/2004	2298
3/8/2004	2258	4/18/2004	2299
3/9/2004	2259	4/19/2004	2300
3/10/2004	2260	4/20/2004	2301
3/11/2004	2261	4/21/2004	2302
3/12/2004	2262	4/22/2004	2303
3/13/2004	2263	4/23/2004	2304
3/14/2004	2264	4/24/2004	2305
3/15/2004	2265	4/25/2004	2306
3/16/2004	2266	4/26/2004	2307
3/17/2004	2267	4/27/2004	2308
3/18/2004	2268	4/28/2004	2309
3/19/2004	2269	4/29/2004	2310
3/20/2004	2270	4/30/2004	2311
3/21/2004	2271	5/1/2004	2312
3/22/2004	2272	5/2/2004	2313
3/23/2004	2273	5/3/2004	2314
3/24/2004	2274	5/4/2004	2315
3/25/2004	2275	5/5/2004	2316

Calibration Date	Number of Days	Calibration Date	Number of Days
5/6/2004	2317	6/16/2004	2358
5/7/2004	2318	6/17/2004	2359
5/8/2004	2319	6/18/2004	2360
5/9/2004	2320	6/19/2004	2361
5/10/2004	2321	6/20/2004	2362
5/11/2004	2322	6/21/2004	2363
5/12/2004	2323	6/22/2004	2364
5/13/2004	2324	6/23/2004	2365
5/14/2004	2325	6/24/2004	2366
5/15/2004	2326	6/25/2004	2367
5/16/2004	2327	6/26/2004	2368
5/17/2004	2328	6/27/2004	2369
5/18/2004	2329	6/28/2004	2370
5/19/2004	2330	6/29/2004	2371
5/20/2004	2331	6/30/2004	2372
5/21/2004	2332	7/1/2004	2373
5/22/2004	2333	7/2/2004	2374
5/23/2004	2334	7/3/2004	2375
5/24/2004	2335	7/4/2004	2376
5/25/2004	2336	7/5/2004	2377
5/26/2004	2337	7/6/2004	2378
5/27/2004	2338	7/7/2004	2379
5/28/2004	2339	7/8/2004	2380
5/29/2004	2340	7/9/2004	2381
5/30/2004	2341	7/10/2004	2382
5/31/2004	2342	7/11/2004	2383
6/1/2004	2343	7/12/2004	2384
6/2/2004	2344	7/13/2004	2385
6/3/2004	2345	7/14/2004	2386
6/4/2004	2346	7/15/2004	2387
6/5/2004	2347	7/16/2004	2388
6/6/2004	2348	7/17/2004	2389
6/7/2004	2349	7/18/2004	2390
6/8/2004	2350	7/19/2004	2391
6/9/2004	2351	7/20/2004	2392
6/10/2004	2352	7/21/2004	2393
6/11/2004	2353	7/22/2004	2394
6/12/2004	2354	7/23/2004	2395
6/13/2004	2355	7/24/2004	2396
6/14/2004	2356	7/25/2004	2397
6/15/2004	2357	7/26/2004	2398

Calibration Date	Number of Days	Calibration Date	Number of Days
7/27/2004	2399	9/6/2004	2440
7/28/2004	2400	9/7/2004	2441
7/29/2004	2401	9/8/2004	2442
7/30/2004	2402	9/9/2004	2443
7/31/2004	2403	9/10/2004	2444
8/1/2004	2404	9/11/2004	2445
8/2/2004	2405	9/12/2004	2446
8/3/2004	2406	9/13/2004	2447
8/4/2004	2407	9/14/2004	2448
8/5/2004	2408	9/15/2004	2449
8/6/2004	2409	9/16/2004	2450
8/7/2004	2410	9/17/2004	2451
8/8/2004	2411	9/18/2004	2452
8/9/2004	2412	9/19/2004	2453
8/10/2004	2413	9/20/2004	2454
8/11/2004	2414	9/21/2004	2455
8/12/2004	2415	9/22/2004	2456
8/13/2004	2416	9/23/2004	2457
8/14/2004	2417	9/24/2004	2458
8/15/2004	2418	9/25/2004	2459
8/16/2004	2419	9/26/2004	2460
8/17/2004	2420	9/27/2004	2461
8/18/2004	2421	9/28/2004	2462
8/19/2004	2422	9/29/2004	2463
8/20/2004	2423	9/30/2004	2464
8/21/2004	2424	10/1/2004	2465
8/22/2004	2425	10/2/2004	2466
8/23/2004	2426	10/3/2004	2467
8/24/2004	2427	10/4/2004	2468
8/25/2004	2428	10/5/2004	2469
8/26/2004	2429	10/6/2004	2470
8/27/2004	2430	10/7/2004	2471
8/28/2004	2431	10/8/2004	2472
8/29/2004	2432	10/9/2004	2473
8/30/2004	2433	10/10/2004	2474
8/31/2004	2434	10/11/2004	2475
9/1/2004	2435	10/12/2004	2476
9/2/2004	2436	10/13/2004	2477
9/3/2004	2437	10/14/2004	2478
9/4/2004	2438	10/15/2004	2479
9/5/2004	2439	10/16/2004	2480

Calibration Date	Number of Days	Calibration Date	Number of Days
10/17/2004	2481	11/27/2004	2522
10/18/2004	2482	11/28/2004	2523
10/19/2004	2483	11/29/2004	2524
10/20/2004	2484	11/30/2004	2525
10/21/2004	2485	12/1/2004	2526
10/22/2004	2486	12/2/2004	2527
10/23/2004	2487	12/3/2004	2528
10/24/2004	2488	12/4/2004	2529
10/25/2004	2489	12/5/2004	2530
10/26/2004	2490	12/6/2004	2531
10/27/2004	2491	12/7/2004	2532
10/28/2004	2492	12/8/2004	2533
10/29/2004	2493	12/9/2004	2534
10/30/2004	2494	12/10/2004	2535
10/31/2004	2495	12/11/2004	2536
11/1/2004	2496	12/12/2004	2537
11/2/2004	2497	12/13/2004	2538
11/3/2004	2498	12/14/2004	2539
11/4/2004	2499	12/15/2004	2540
11/5/2004	2500	12/16/2004	2541
11/6/2004	2501	12/17/2004	2542
11/7/2004	2502	12/18/2004	2543
11/8/2004	2503	12/19/2004	2544
11/9/2004	2504	12/20/2004	2545
11/10/2004	2505	12/21/2004	2546
11/11/2004	2506	12/22/2004	2547
11/12/2004	2507	12/23/2004	2548
11/13/2004	2508	12/24/2004	2549
11/14/2004	2509	12/25/2004	2550
11/15/2004	2510	12/26/2004	2551
11/16/2004	2511	12/27/2004	2552
11/17/2004	2512	12/28/2004	2553
11/18/2004	2513	12/29/2004	2554
11/19/2004	2514	12/30/2004	2555
11/20/2004	2515	12/31/2004	2556
11/21/2004	2516	1/1/2005	2557
11/22/2004	2517	1/2/2005	2558
11/23/2004	2518	1/3/2005	2559
11/24/2004	2519	1/4/2005	2560
11/25/2004	2520	1/5/2005	2561
11/26/2004	2521	1/6/2005	2562

Calibration Date	Number of Days	Calibration Date	Number of Days
1/7/2005	2563	2/17/2005	2604
1/8/2005	2564	2/18/2005	2605
1/9/2005	2565	2/19/2005	2606
1/10/2005	2566	2/20/2005	2607
1/11/2005	2567	2/21/2005	2608
1/12/2005	2568	2/22/2005	2609
1/13/2005	2569	2/23/2005	2610
1/14/2005	2570	2/24/2005	2611
1/15/2005	2571	2/25/2005	2612
1/16/2005	2572	2/26/2005	2613
1/17/2005	2573	2/27/2005	2614
1/18/2005	2574	2/28/2005	2615
1/19/2005	2575	3/1/2005	2616
1/20/2005	2576	3/2/2005	2617
1/21/2005	2577	3/3/2005	2618
1/22/2005	2578	3/4/2005	2619
1/23/2005	2579	3/5/2005	2620
1/24/2005	2580	3/6/2005	2621
1/25/2005	2581	3/7/2005	2622
1/26/2005	2582	3/8/2005	2623
1/27/2005	2583	3/9/2005	2624
1/28/2005	2584	3/10/2005	2625
1/29/2005	2585	3/11/2005	2626
1/30/2005	2586	3/12/2005	2627
1/31/2005	2587	3/13/2005	2628
2/1/2005	2588	3/14/2005	2629
2/2/2005	2589	3/15/2005	2630
2/3/2005	2590	3/16/2005	2631
2/4/2005	2591	3/17/2005	2632
2/5/2005	2592	3/18/2005	2633
2/6/2005	2593	3/19/2005	2634
2/7/2005	2594	3/20/2005	2635
2/8/2005	2595	3/21/2005	2636
2/9/2005	2596	3/22/2005	2637
2/10/2005	2597	3/23/2005	2638
2/11/2005	2598	3/24/2005	2639
2/12/2005	2599	3/25/2005	2640
2/13/2005	2600	3/26/2005	2641
2/14/2005	2601	3/27/2005	2642
2/15/2005	2602	3/28/2005	2643
2/16/2005	2603	3/29/2005	2644

Calibration Date	Number of Days	Calibration Date	Number of Days
3/30/2005	2645	5/10/2005	2686
3/31/2005	2646	5/11/2005	2687
4/1/2005	2647	5/12/2005	2688
4/2/2005	2648	5/13/2005	2689
4/3/2005	2649	5/14/2005	2690
4/4/2005	2650	5/15/2005	2691
4/5/2005	2651	5/16/2005	2692
4/6/2005	2652	5/17/2005	2693
4/7/2005	2653	5/18/2005	2694
4/8/2005	2654	5/19/2005	2695
4/9/2005	2655	5/20/2005	2696
4/10/2005	2656	5/21/2005	2697
4/11/2005	2657	5/22/2005	2698
4/12/2005	2658	5/23/2005	2699
4/13/2005	2659	5/24/2005	2700
4/14/2005	2660	5/25/2005	2701
4/15/2005	2661	5/26/2005	2702
4/16/2005	2662	5/27/2005	2703
4/17/2005	2663	5/28/2005	2704
4/18/2005	2664	5/29/2005	2705
4/19/2005	2665	5/30/2005	2706
4/20/2005	2666	5/31/2005	2707
4/21/2005	2667	6/1/2005	2708
4/22/2005	2668	6/2/2005	2709
4/23/2005	2669	6/3/2005	2710
4/24/2005	2670	6/4/2005	2711
4/25/2005	2671	6/5/2005	2712
4/26/2005	2672	6/6/2005	2713
4/27/2005	2673	6/7/2005	2714
4/28/2005	2674	6/8/2005	2715
4/29/2005	2675	6/9/2005	2716
4/30/2005	2676	6/10/2005	2717
5/1/2005	2677	6/11/2005	2718
5/2/2005	2678	6/12/2005	2719
5/3/2005	2679	6/13/2005	2720
5/4/2005	2680	6/14/2005	2721
5/5/2005	2681	6/15/2005	2722
5/6/2005	2682	6/16/2005	2723
5/7/2005	2683	6/17/2005	2724
5/8/2005	2684	6/18/2005	2725
5/9/2005	2685	6/19/2005	2726

Calibration Date	Number of Days	Calibration Date	Number of Days
6/20/2005	2727	7/31/2005	2768
6/21/2005	2728	8/1/2005	2769
6/22/2005	2729	8/2/2005	2770
6/23/2005	2730	8/3/2005	2771
6/24/2005	2731	8/4/2005	2772
6/25/2005	2732	8/5/2005	2773
6/26/2005	2733	8/6/2005	2774
6/27/2005	2734	8/7/2005	2775
6/28/2005	2735	8/8/2005	2776
6/29/2005	2736	8/9/2005	2777
6/30/2005	2737	8/10/2005	2778
7/1/2005	2738	8/11/2005	2779
7/2/2005	2739	8/12/2005	2780
7/3/2005	2740	8/13/2005	2781
7/4/2005	2741	8/14/2005	2782
7/5/2005	2742	8/15/2005	2783
7/6/2005	2743	8/16/2005	2784
7/7/2005	2744	8/17/2005	2785
7/8/2005	2745	8/18/2005	2786
7/9/2005	2746	8/19/2005	2787
7/10/2005	2747	8/20/2005	2788
7/11/2005	2748	8/21/2005	2789
7/12/2005	2749	8/22/2005	2790
7/13/2005	2750	8/23/2005	2791
7/14/2005	2751	8/24/2005	2792
7/15/2005	2752	8/25/2005	2793
7/16/2005	2753	8/26/2005	2794
7/17/2005	2754	8/27/2005	2795
7/18/2005	2755	8/28/2005	2796
7/19/2005	2756	8/29/2005	2797
7/20/2005	2757	8/30/2005	2798
7/21/2005	2758	8/31/2005	2799
7/22/2005	2759	9/1/2005	2800
7/23/2005	2760	9/2/2005	2801
7/24/2005	2761	9/3/2005	2802
7/25/2005	2762	9/4/2005	2803
7/26/2005	2763	9/5/2005	2804
7/27/2005	2764	9/6/2005	2805
7/28/2005	2765	9/7/2005	2806
7/29/2005	2766	9/8/2005	2807
7/30/2005	2767	9/9/2005	2808

Calibration Date	Number of Days	Calibration Date	Number of Days
9/10/2005	2809	10/21/2005	2850
9/11/2005	2810	10/22/2005	2851
9/12/2005	2811	10/23/2005	2852
9/13/2005	2812	10/24/2005	2853
9/14/2005	2813	10/25/2005	2854
9/15/2005	2814	10/26/2005	2855
9/16/2005	2815	10/27/2005	2856
9/17/2005	2816	10/28/2005	2857
9/18/2005	2817	10/29/2005	2858
9/19/2005	2818	10/30/2005	2859
9/20/2005	2819	10/31/2005	2860
9/21/2005	2820	11/1/2005	2861
9/22/2005	2821	11/2/2005	2862
9/23/2005	2822	11/3/2005	2863
9/24/2005	2823	11/4/2005	2864
9/25/2005	2824	11/5/2005	2865
9/26/2005	2825	11/6/2005	2866
9/27/2005	2826	11/7/2005	2867
9/28/2005	2827	11/8/2005	2868
9/29/2005	2828	11/9/2005	2869
9/30/2005	2829	11/10/2005	2870
10/1/2005	2830	11/11/2005	2871
10/2/2005	2831	11/12/2005	2872
10/3/2005	2832	11/13/2005	2873
10/4/2005	2833	11/14/2005	2874
10/5/2005	2834	11/15/2005	2875
10/6/2005	2835	11/16/2005	2876
10/7/2005	2836	11/17/2005	2877
10/8/2005	2837	11/18/2005	2878
10/9/2005	2838	11/19/2005	2879
10/10/2005	2839	11/20/2005	2880
10/11/2005	2840	11/21/2005	2881
10/12/2005	2841	11/22/2005	2882
10/13/2005	2842	11/23/2005	2883
10/14/2005	2843	11/24/2005	2884
10/15/2005	2844	11/25/2005	2885
10/16/2005	2845	11/26/2005	2886
10/17/2005	2846	11/27/2005	2887
10/18/2005	2847	11/28/2005	2888
10/19/2005	2848	11/29/2005	2889
10/20/2005	2849	11/30/2005	2890

Calibration Date	Number of Days	Calibration Date	Number of Days
12/1/2005	2891	1/11/2006	2932
12/2/2005	2892	1/12/2006	2933
12/3/2005	2893	1/13/2006	2934
12/4/2005	2894	1/14/2006	2935
12/5/2005	2895	1/15/2006	2936
12/6/2005	2896	1/16/2006	2937
12/7/2005	2897	1/17/2006	2938
12/8/2005	2898	1/18/2006	2939
12/9/2005	2899	1/19/2006	2940
12/10/2005	2900	1/20/2006	2941
12/11/2005	2901	1/21/2006	2942
12/12/2005	2902	1/22/2006	2943
12/13/2005	2903	1/23/2006	2944
12/14/2005	2904	1/24/2006	2945
12/15/2005	2905	1/25/2006	2946
12/16/2005	2906	1/26/2006	2947
12/17/2005	2907	1/27/2006	2948
12/18/2005	2908	1/28/2006	2949
12/19/2005	2909	1/29/2006	2950
12/20/2005	2910	1/30/2006	2951
12/21/2005	2911	1/31/2006	2952
12/22/2005	2912	2/1/2006	2953
12/23/2005	2913	2/2/2006	2954
12/24/2005	2914	2/3/2006	2955
12/25/2005	2915	2/4/2006	2956
12/26/2005	2916	2/5/2006	2957
12/27/2005	2917	2/6/2006	2958
12/28/2005	2918	2/7/2006	2959
12/29/2005	2919	2/8/2006	2960
12/30/2005	2920	2/9/2006	2961
12/31/2005	2921	2/10/2006	2962
1/1/2006	2922	2/11/2006	2963
1/2/2006	2923	2/12/2006	2964
1/3/2006	2924	2/13/2006	2965
1/4/2006	2925	2/14/2006	2966
1/5/2006	2926	2/15/2006	2967
1/6/2006	2927	2/16/2006	2968
1/7/2006	2928	2/17/2006	2969
1/8/2006	2929	2/18/2006	2970
1/9/2006	2930	2/19/2006	2971
1/10/2006	2931	2/20/2006	2972

Calibration Date	Number of Days	Calibration Date	Number of Days
2/21/2006	2973	4/3/2006	3014
2/22/2006	2974	4/4/2006	3015
2/23/2006	2975	4/5/2006	3016
2/24/2006	2976	4/6/2006	3017
2/25/2006	2977	4/7/2006	3018
2/26/2006	2978	4/8/2006	3019
2/27/2006	2979	4/9/2006	3020
2/28/2006	2980	4/10/2006	3021
3/1/2006	2981	4/11/2006	3022
3/2/2006	2982	4/12/2006	3023
3/3/2006	2983	4/13/2006	3024
3/4/2006	2984	4/14/2006	3025
3/5/2006	2985	4/15/2006	3026
3/6/2006	2986	4/16/2006	3027
3/7/2006	2987	4/17/2006	3028
3/8/2006	2988	4/18/2006	3029
3/9/2006	2989	4/19/2006	3030
3/10/2006	2990	4/20/2006	3031
3/11/2006	2991	4/21/2006	3032
3/12/2006	2992	4/22/2006	3033
3/13/2006	2993	4/23/2006	3034
3/14/2006	2994	4/24/2006	3035
3/15/2006	2995	4/25/2006	3036
3/16/2006	2996	4/26/2006	3037
3/17/2006	2997	4/27/2006	3038
3/18/2006	2998	4/28/2006	3039
3/19/2006	2999	4/29/2006	3040
3/20/2006	3000	4/30/2006	3041
3/21/2006	3001	5/1/2006	3042
3/22/2006	3002	5/2/2006	3043
3/23/2006	3003	5/3/2006	3044
3/24/2006	3004	5/4/2006	3045
3/25/2006	3005	5/5/2006	3046
3/26/2006	3006	5/6/2006	3047
3/27/2006	3007	5/7/2006	3048
3/28/2006	3008	5/8/2006	3049
3/29/2006	3009	5/9/2006	3050
3/30/2006	3010	5/10/2006	3051
3/31/2006	3011	5/11/2006	3052
4/1/2006	3012	5/12/2006	3053
4/2/2006	3013	5/13/2006	3054

Calibration Date	Number of Days	Calibration Date	Number of Days
5/14/2006	3055	6/24/2006	3096
5/15/2006	3056	6/25/2006	3097
5/16/2006	3057	6/26/2006	3098
5/17/2006	3058	6/27/2006	3099
5/18/2006	3059	6/28/2006	3100
5/19/2006	3060	6/29/2006	3101
5/20/2006	3061	6/30/2006	3102
5/21/2006	3062	7/1/2006	3103
5/22/2006	3063	7/2/2006	3104
5/23/2006	3064	7/3/2006	3105
5/24/2006	3065	7/4/2006	3106
5/25/2006	3066	7/5/2006	3107
5/26/2006	3067	7/6/2006	3108
5/27/2006	3068	7/7/2006	3109
5/28/2006	3069	7/8/2006	3110
5/29/2006	3070	7/9/2006	3111
5/30/2006	3071	7/10/2006	3112
5/31/2006	3072	7/11/2006	3113
6/1/2006	3073	7/12/2006	3114
6/2/2006	3074	7/13/2006	3115
6/3/2006	3075	7/14/2006	3116
6/4/2006	3076	7/15/2006	3117
6/5/2006	3077	7/16/2006	3118
6/6/2006	3078	7/17/2006	3119
6/7/2006	3079	7/18/2006	3120
6/8/2006	3080	7/19/2006	3121
6/9/2006	3081	7/20/2006	3122
6/10/2006	3082	7/21/2006	3123
6/11/2006	3083	7/22/2006	3124
6/12/2006	3084	7/23/2006	3125
6/13/2006	3085	7/24/2006	3126
6/14/2006	3086	7/25/2006	3127
6/15/2006	3087	7/26/2006	3128
6/16/2006	3088	7/27/2006	3129
6/17/2006	3089	7/28/2006	3130
6/18/2006	3090	7/29/2006	3131
6/19/2006	3091	7/30/2006	3132
6/20/2006	3092	7/31/2006	3133
6/21/2006	3093	8/1/2006	3134
6/22/2006	3094	8/2/2006	3135
6/23/2006	3095	8/3/2006	3136

Calibration Date	Number of Days	Calibration Date	Number of Days
8/4/2006	3137	9/14/2006	3178
8/5/2006	3138	9/15/2006	3179
8/6/2006	3139	9/16/2006	3180
8/7/2006	3140	9/17/2006	3181
8/8/2006	3141	9/18/2006	3182
8/9/2006	3142	9/19/2006	3183
8/10/2006	3143	9/20/2006	3184
8/11/2006	3144	9/21/2006	3185
8/12/2006	3145	9/22/2006	3186
8/13/2006	3146	9/23/2006	3187
8/14/2006	3147	9/24/2006	3188
8/15/2006	3148	9/25/2006	3189
8/16/2006	3149	9/26/2006	3190
8/17/2006	3150	9/27/2006	3191
8/18/2006	3151	9/28/2006	3192
8/19/2006	3152	9/29/2006	3193
8/20/2006	3153	9/30/2006	3194
8/21/2006	3154	10/1/2006	3195
8/22/2006	3155	10/2/2006	3196
8/23/2006	3156	10/3/2006	3197
8/24/2006	3157	10/4/2006	3198
8/25/2006	3158	10/5/2006	3199
8/26/2006	3159	10/6/2006	3200
8/27/2006	3160	10/7/2006	3201
8/28/2006	3161	10/8/2006	3202
8/29/2006	3162	10/9/2006	3203
8/30/2006	3163	10/10/2006	3204
8/31/2006	3164	10/11/2006	3205
9/1/2006	3165	10/12/2006	3206
9/2/2006	3166	10/13/2006	3207
9/3/2006	3167	10/14/2006	3208
9/4/2006	3168	10/15/2006	3209
9/5/2006	3169	10/16/2006	3210
9/6/2006	3170	10/17/2006	3211
9/7/2006	3171	10/18/2006	3212
9/8/2006	3172	10/19/2006	3213
9/9/2006	3173	10/20/2006	3214
9/10/2006	3174	10/21/2006	3215
9/11/2006	3175	10/22/2006	3216
9/12/2006	3176	10/23/2006	3217
9/13/2006	3177	10/24/2006	3218

Calibration Date	Number of Days	Calibration Date	Number of Days
10/25/2006	3219	12/5/2006	3260
10/26/2006	3220	12/6/2006	3261
10/27/2006	3221	12/7/2006	3262
10/28/2006	3222	12/8/2006	3263
10/29/2006	3223	12/9/2006	3264
10/30/2006	3224	12/10/2006	3265
10/31/2006	3225	12/11/2006	3266
11/1/2006	3226	12/12/2006	3267
11/2/2006	3227	12/13/2006	3268
11/3/2006	3228	12/14/2006	3269
11/4/2006	3229	12/15/2006	3270
11/5/2006	3230	12/16/2006	3271
11/6/2006	3231	12/17/2006	3272
11/7/2006	3232	12/18/2006	3273
11/8/2006	3233	12/19/2006	3274
11/9/2006	3234	12/20/2006	3275
11/10/2006	3235	12/21/2006	3276
11/11/2006	3236	12/22/2006	3277
11/12/2006	3237	12/23/2006	3278
11/13/2006	3238	12/24/2006	3279
11/14/2006	3239	12/25/2006	3280
11/15/2006	3240	12/26/2006	3281
11/16/2006	3241	12/27/2006	3282
11/17/2006	3242	12/28/2006	3283
11/18/2006	3243	12/29/2006	3284
11/19/2006	3244	12/30/2006	3285
11/20/2006	3245	12/31/2006	3286
11/21/2006	3246	1/1/2007	3287
11/22/2006	3247	1/2/2007	3288
11/23/2006	3248	1/3/2007	3289
11/24/2006	3249	1/4/2007	3290
11/25/2006	3250	1/5/2007	3291
11/26/2006	3251	1/6/2007	3292
11/27/2006	3252	1/7/2007	3293
11/28/2006	3253	1/8/2007	3294
11/29/2006	3254	1/9/2007	3295
11/30/2006	3255	1/10/2007	3296
12/1/2006	3256	1/11/2007	3297
12/2/2006	3257	1/12/2007	3298
12/3/2006	3258	1/13/2007	3299
12/4/2006	3259	1/14/2007	3300

Calibration Date	Number of Days	Calibration Date	Number of Days
1/15/2007	3301	2/25/2007	3342
1/16/2007	3302	2/26/2007	3343
1/17/2007	3303	2/27/2007	3344
1/18/2007	3304	2/28/2007	3345
1/19/2007	3305	3/1/2007	3346
1/20/2007	3306	3/2/2007	3347
1/21/2007	3307	3/3/2007	3348
1/22/2007	3308	3/4/2007	3349
1/23/2007	3309	3/5/2007	3350
1/24/2007	3310	3/6/2007	3351
1/25/2007	3311	3/7/2007	3352
1/26/2007	3312	3/8/2007	3353
1/27/2007	3313	3/9/2007	3354
1/28/2007	3314	3/10/2007	3355
1/29/2007	3315	3/11/2007	3356
1/30/2007	3316	3/12/2007	3357
1/31/2007	3317	3/13/2007	3358
2/1/2007	3318	3/14/2007	3359
2/2/2007	3319	3/15/2007	3360
2/3/2007	3320	3/16/2007	3361
2/4/2007	3321	3/17/2007	3362
2/5/2007	3322	3/18/2007	3363
2/6/2007	3323	3/19/2007	3364
2/7/2007	3324	3/20/2007	3365
2/8/2007	3325	3/21/2007	3366
2/9/2007	3326	3/22/2007	3367
2/10/2007	3327	3/23/2007	3368
2/11/2007	3328	3/24/2007	3369
2/12/2007	3329	3/25/2007	3370
2/13/2007	3330	3/26/2007	3371
2/14/2007	3331	3/27/2007	3372
2/15/2007	3332	3/28/2007	3373
2/16/2007	3333	3/29/2007	3374
2/17/2007	3334	3/30/2007	3375
2/18/2007	3335	3/31/2007	3376
2/19/2007	3336	4/1/2007	3377
2/20/2007	3337	4/2/2007	3378
2/21/2007	3338	4/3/2007	3379
2/22/2007	3339	4/4/2007	3380
2/23/2007	3340	4/5/2007	3381
2/24/2007	3341	4/6/2007	3382

Calibration Date	Number of Days	Calibration Date	Number of Days
4/7/2007	3383	5/18/2007	3424
4/8/2007	3384	5/19/2007	3425
4/9/2007	3385	5/20/2007	3426
4/10/2007	3386	5/21/2007	3427
4/11/2007	3387	5/22/2007	3428
4/12/2007	3388	5/23/2007	3429
4/13/2007	3389	5/24/2007	3430
4/14/2007	3390	5/25/2007	3431
4/15/2007	3391	5/26/2007	3432
4/16/2007	3392	5/27/2007	3433
4/17/2007	3393	5/28/2007	3434
4/18/2007	3394	5/29/2007	3435
4/19/2007	3395	5/30/2007	3436
4/20/2007	3396	5/31/2007	3437
4/21/2007	3397	6/1/2007	3438
4/22/2007	3398	6/2/2007	3439
4/23/2007	3399	6/3/2007	3440
4/24/2007	3400	6/4/2007	3441
4/25/2007	3401	6/5/2007	3442
4/26/2007	3402	6/6/2007	3443
4/27/2007	3403	6/7/2007	3444
4/28/2007	3404	6/8/2007	3445
4/29/2007	3405	6/9/2007	3446
4/30/2007	3406	6/10/2007	3447
5/1/2007	3407	6/11/2007	3448
5/2/2007	3408	6/12/2007	3449
5/3/2007	3409	6/13/2007	3450
5/4/2007	3410	6/14/2007	3451
5/5/2007	3411	6/15/2007	3452
5/6/2007	3412	6/16/2007	3453
5/7/2007	3413	6/17/2007	3454
5/8/2007	3414	6/18/2007	3455
5/9/2007	3415	6/19/2007	3456
5/10/2007	3416	6/20/2007	3457
5/11/2007	3417	6/21/2007	3458
5/12/2007	3418	6/22/2007	3459
5/13/2007	3419	6/23/2007	3460
5/14/2007	3420	6/24/2007	3461
5/15/2007	3421	6/25/2007	3462
5/16/2007	3422	6/26/2007	3463
5/17/2007	3423	6/27/2007	3464

Calibration Date	Number of Days	Calibration Date	Number of Days
6/28/2007	3465	8/8/2007	3506
6/29/2007	3466	8/9/2007	3507
6/30/2007	3467	8/10/2007	3508
7/1/2007	3468	8/11/2007	3509
7/2/2007	3469	8/12/2007	3510
7/3/2007	3470	8/13/2007	3511
7/4/2007	3471	8/14/2007	3512
7/5/2007	3472	8/15/2007	3513
7/6/2007	3473	8/16/2007	3514
7/7/2007	3474	8/17/2007	3515
7/8/2007	3475	8/18/2007	3516
7/9/2007	3476	8/19/2007	3517
7/10/2007	3477	8/20/2007	3518
7/11/2007	3478	8/21/2007	3519
7/12/2007	3479	8/22/2007	3520
7/13/2007	3480	8/23/2007	3521
7/14/2007	3481	8/24/2007	3522
7/15/2007	3482	8/25/2007	3523
7/16/2007	3483	8/26/2007	3524
7/17/2007	3484	8/27/2007	3525
7/18/2007	3485	8/28/2007	3526
7/19/2007	3486	8/29/2007	3527
7/20/2007	3487	8/30/2007	3528
7/21/2007	3488	8/31/2007	3529
7/22/2007	3489	9/1/2007	3530
7/23/2007	3490	9/2/2007	3531
7/24/2007	3491	9/3/2007	3532
7/25/2007	3492	9/4/2007	3533
7/26/2007	3493	9/5/2007	3534
7/27/2007	3494	9/6/2007	3535
7/28/2007	3495	9/7/2007	3536
7/29/2007	3496	9/8/2007	3537
7/30/2007	3497	9/9/2007	3538
7/31/2007	3498	9/10/2007	3539
8/1/2007	3499	9/11/2007	3540
8/2/2007	3500	9/12/2007	3541
8/3/2007	3501	9/13/2007	3542
8/4/2007	3502	9/14/2007	3543
8/5/2007	3503	9/15/2007	3544
8/6/2007	3504	9/16/2007	3545
8/7/2007	3505	9/17/2007	3546

Calibration Date	Number of Days	Calibration Date	Number of Days
9/18/2007	3547	10/29/2007	3588
9/19/2007	3548	10/30/2007	3589
9/20/2007	3549	10/31/2007	3590
9/21/2007	3550	11/1/2007	3591
9/22/2007	3551	11/2/2007	3592
9/23/2007	3552	11/3/2007	3593
9/24/2007	3553	11/4/2007	3594
9/25/2007	3554	11/5/2007	3595
9/26/2007	3555	11/6/2007	3596
9/27/2007	3556	11/7/2007	3597
9/28/2007	3557	11/8/2007	3598
9/29/2007	3558	11/9/2007	3599
9/30/2007	3559	11/10/2007	3600
10/1/2007	3560	11/11/2007	3601
10/2/2007	3561	11/12/2007	3602
10/3/2007	3562	11/13/2007	3603
10/4/2007	3563	11/14/2007	3604
10/5/2007	3564	11/15/2007	3605
10/6/2007	3565	11/16/2007	3606
10/7/2007	3566	11/17/2007	3607
10/8/2007	3567	11/18/2007	3608
10/9/2007	3568	11/19/2007	3609
10/10/2007	3569	11/20/2007	3610
10/11/2007	3570	11/21/2007	3611
10/12/2007	3571	11/22/2007	3612
10/13/2007	3572	11/23/2007	3613
10/14/2007	3573	11/24/2007	3614
10/15/2007	3574	11/25/2007	3615
10/16/2007	3575	11/26/2007	3616
10/17/2007	3576	11/27/2007	3617
10/18/2007	3577	11/28/2007	3618
10/19/2007	3578	11/29/2007	3619
10/20/2007	3579	11/30/2007	3620
10/21/2007	3580	12/1/2007	3621
10/22/2007	3581	12/2/2007	3622
10/23/2007	3582	12/3/2007	3623
10/24/2007	3583	12/4/2007	3624
10/25/2007	3584	12/5/2007	3625
10/26/2007	3585	12/6/2007	3626
10/27/2007	3586	12/7/2007	3627
10/28/2007	3587	12/8/2007	3628

Calibration Date	Number of Days	Calibration Date	Number of Days
12/9/2007	3629		
12/10/2007	3630		
12/11/2007	3631		
12/12/2007	3632		
12/13/2007	3633		
12/14/2007	3634		
12/15/2007	3635		
12/16/2007	3636		
12/17/2007	3637		
12/18/2007	3638		
12/19/2007	3639		
12/20/2007	3640		
12/21/2007	3641		
12/22/2007	3642		
12/23/2007	3643		
12/24/2007	3644		
12/25/2007	3645		
12/26/2007	3646		
12/27/2007	3647		
12/28/2007	3648		
12/29/2007	3649		
12/30/2007	3650		
12/31/2007	3651		

Table F-1. Changed to a new BP Valve

Model	Serial#
621N0	62201361
621SP	62100948
622N0	62201361
622NP	62201357
623SP	62300410
623NP	62300412

Table F-2. Changed E-Pac. Changed to class B power supply.

Model	Serial#
621S0	62100935
621SP	62100941
622S0	62101305
622SP	62200135
622N0	62201305
622NP	62201312
623SP	62300405
623NP	62300408

Table F-3. Upgraded printer cable to a cable with foam tape attached.

Model	Serial#
621xx	62104069
622xx	62208111
623xx	62304018

The foam tape ads extra safety into the printer cable.

Table F-4. Upgraded the Main PCB from 501 to 502.

Model	Serial#
621xx	62103000
622xx	62206000
623xx	62303000

Upgraded the Main PCB to make it ESU tolerant. Added user feature to print on alarm or not print on alarm. Software changed to 2.2

Table F-5. Upgraded the Nellcor SpO_2 PCB from 204/205 to 506.

Model	Serial#
621xx	62104000
622xx	62208000
623xx	62304000

NOTE: *The new Nellcor 506 SpO_2 PCB is backward compatibly. The new 506 SpO_2 sensor extension cable "DEC-8", that can be identified by the purple connector, is backward compatible with the older 204/205 SpO_2 PCB. The older 204/205 SpO_2 sensor extension cable "EC-8", that can be identified by the gray connector, will not work "it will not physically plug into the Atlas connector" with the new Nellcor 506 SpO_2 PCB. The software was changed to version 2.5.*

The older sensors, that are indentified by the gray connector, will not work with the newer sensor extension cables even though the sensor will physically plug into the newer sensor extension cable "DEC-8". The newer patient sensors have a purple connector and will work on the older sensor extension cables.

Atlas Calibration and Function Test Form

Atlas Model Number_____ Atlas Serial Number_____
Calibration date_____ Last Calibration date_____
Software Version_____ Boot Revision_____
SpO_2 Manufacture_____ SpO_2 PCB_____
SpO_2 Software Revision_____ CO_2 Revision_____
Last CO_2 Reset Date:_____ Last CO_2 Calibration_____

N/A=Not Applicable

Calibration Results

PASS FAIL ***Place a check mark by each of the following data items***

_____ _____ Date and time accuracy
_____ _____ BP calibration (50mmHg and 250mmHd)
_____ _____ CO_2 reset
_____ _____ CO_2 calibration
_____ _____ No load battery voltage calibration
_____ _____ Battery voltage calibration
_____ _____ Printer adjustment
_____ _____ Calibration date set
_____ _____ Software upgrade
_____ _____ Download NVRAM files

Functional test Results

_____ _____ Power on self test
_____ _____ Menu functional test
_____ _____ BP dymanic test
_____ _____ BP statc test
_____ _____ Over 15mmHg test
_____ _____ BP Dump test
_____ _____ Hardware functional test
_____ _____ ECG/Respiration test
_____ _____ SpO_2 test
_____ _____ Temperature test
_____ _____ CO_2 functional test
_____ _____ Battery functional tests
_____ _____ Printer functional test
_____ _____ Print on alarm test
_____ _____ ECG alarm test
_____ _____ Respiration alarm test
_____ _____ Silence alarm test
_____ _____ CO_2/Respiration test
_____ _____ Blood Pressure alarm test

Date Completed_____ Technician_____